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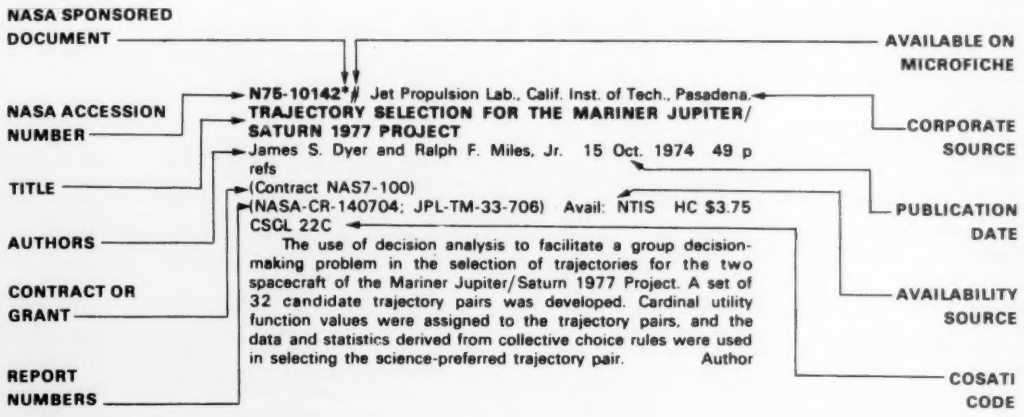
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TRAJECTORY SELECTION FOR THE MARINER JUPITER/ SATURN 1977 PROJECT
TITLE
James S. Dyer and Ralph F. Miles, Jr. 15 Oct. 1974 49 p refs
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REPORT NUMBERS
The use of decision analysis to facilitate a group decision-making problem in the selection of trajectories for the two spacecraft of the Mariner Jupiter/Saturn 1977 Project. A set of 32 candidate trajectory pairs was developed. Cardinal utility function values were assigned to the trajectory pairs, and the data and statistics derived from collective choice rules were used in selecting the science-preferred trajectory pair. Author
COSATI CODE

ON-GOING RESEARCH PROJECTS

This is a listing of research projects — not publications

AERONAUTICS

Includes Aeronautics (general); Aerodynamics; Air Transportation and Safety; Aircraft Communications and Navigation; Aircraft Design, Testing, and Performance; Aircraft Instrumentation; Aircraft Propulsion and Power; Aircraft Stability and Control; and Research And Support Facilities (air). For Related Information See Also Astronautics.

1.0001, SMOOTHNESS ANALYSIS

W.J. HORN, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0M8181)

The principal objective of this study are; (a) to extend the work of the initial study conducted under the SRHLRPR to incorporate aircraft response data from the entire range of aircraft operating from military runways; (b) to refine the definition of roughness based upon the additional aircraft response data, airframe fatigue consideration and human comfort requirements; (c) to study further the utility of the quantity of absorbed power as a measure of pavement roughness with particular application as a means of determining those areas of existing runways which need repair or rehabilitation; and, (d) provide needed smoothness criteria input for the improved method of pavement design.

Measured aircraft response data will be coupled with measured runway profile data and pilot and crew evaluations in an effort to establish a solid correlation between aircraft response and runway unevenness for a range of aircraft types. Absorbed power will be calculated analytically with the aid of the Universal Aircraft Computer Code developed at the Flight Dynamics Lab and with the measured runway profile as input data. The analytically computed values will then be compared with measured values of absorbed power to determine the merit of both the computer program and the quantity of absorbed power. Statistical studies will be conducted on the measured runway profile data from a number of runways and compared with the measured aircraft responses, pilot evaluations, and the results of absorbed power computations to determine a statistical criterion that can be used to evaluate the smoothness condition of a runway from profile data. Aircraft fatigue data will be collected from aircraft manufacturers and used along with the aircraft simulation computer code to determine what form of runway unevenness is required to produce aircraft responses that endanger the structural integrity of the aircraft.

Supporting agency address information: OCE US Army Engineer Waterways Experiment Station, PO Box 631, Vicksburg, Ms 39180

SUPPORTED BY U.S. Dept. of Defense - Army

1.0002, COMMUNICATIONS - OPTICAL AND ACOUSTIC COMMUNICATIONS

M.H. BLOOM, Polytechnic Inst. of New York, School of Engineering, *Brooklyn, New York* 11201 (DN475358; N00014-67-A-0438-0017)

The propagation of waves through turbulent media and the detection of waves with random fluctuations will be studied. The objective is to develop signal processing techniques to improve the reception of signals altered by propagation through non-uniform media.

The propagation of signals in the presence of random fluctuations and scattering phenomena will be studied. The results of these fluctuations on the detected signal will be analyzed. Signal processing techniques to reduce the noise in the detected signal will be studied.

Supporting agency address information: Office of Naval Research 427, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

1.0003, EVALUATION OF ENGINES OF INTEREST TO MILITARY

C. MEYER, U.S. Natl. Aero. & Space Adm., Airbreathing Engines Division, *Cleveland, Ohio* 44135 (RTOP505-11-41)

Description: To evaluate the performance and response of engines and their components, of interest to the Military over a range of engine and simulated flight conditions. Conditions to be simulated and problems to be investigated will be related to the specific engine or engines. Engines of potential interest include the ATF-3 turbofan with potential RPV application. Tests of the ATF-3 engine were accomplished in the time period between October 1972 and July 1973.

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0004, UPDATE AND MODIFICATION OF WEIGHT/COST ANALYSIS COMPUTER PROGRAMS

D.E. NELSON, U.S. Air Force, Flight Dynamics Lab., *Dayton, Ohio* 45433 (DF134690)

The Air Force, in order to maintain air superiority, must obtain advanced aerospace vehicles and modify existing systems. Reliable cost and weight analysis is required if these systems are to have maximum performance at the lowest cost. In order to make maximum use of manpower, computer programs must be used as tools in performing these analyses. Constant effort must be maintained to keep these tools technically accurate, efficient, and up-to-date.

Programs currently in use by the cost and weight analysis group will be checked for technical accuracy. After assuring accuracy, the programs will be altered to decrease core and run time requirements. Changes will be made to incorporate the most recent advances in cost/weight analysis technology.

Supporting agency address information: AF Flight Dynamics Laboratory FBR, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

1.0005, MICROFOG LUBRICATION FOR BEARINGS AND GEARS

L.B. SIBLEY, S K F Industries Incorporated, *Norristown, Pennsylvania* 19406 (RTOP 505-04-41)

Description: The objectives of this program are to experimentally determine by series of rig studies the applicability of a once-through microfog mist lubrication system for high speed aircraft engine bearings and helicopter gears and to evaluate aspirator type emergency lubrication systems. Using lubrication and cooling concepts from previous microfog application contract studies at Mobil Research, full- scale, 125-mm and 46-mm bore bearing test rigs were used to study several selected lubricant-mist applicator-cooling combinations at speeds to give up to 3x10 to the sixth power DN values (product of speed in rpm and bearing bore diameter in mm) and bearing outer race temperatures to 500 degrees F. Following short-term step-speed testing, 50-hour mist system studies are being conducted at the highest feasible speed conditions. In the mist-gear work the feasibility of operating a 3-1/2 inch diameter Ryder type gear with microfog lubrication has

been demonstrated in preliminary studies using a NASA-developed reclassifier nozzle and cooling air (at 200 degrees F), at loads up to 200,000 psi (max. Hertz stress), 12,500 rpm speeds, and gear temperatures to 500 degrees F. Longer term gear testing studies are now underway.

SUPPORTED BY U.S. Dept. of Defense - Army

1.0006, NEW GEAR TOOTH FORM

A.J. LEMANSKI, Boeing Company, *Philadelphia, Pennsylvania* 19142 (RTOP: 505-04-41)

Description: Determine by computer design and subsequent testing the effect of improved tooth forms on load capacity and fatigue life of aircraft gears. Program comprises computer analysis to evaluate analytically the optimum tooth form to minimize sliding and improve load capacity. Load scoring, surface pitting and tooth bending fatigue tests will be conducted with the new tooth forms under other programs and compared with conventional gears to determine their comparative rating.

SUPPORTED BY U.S. Dept. of Defense - Army

1.0007, EVALUATION OF RUNWAY STRENGTH FOR L.C.N.

A.K. GOONEWARDANE, Ceylonese Dept. of Highways, *Ratmalana, Republic of Sri Lanka* (115900 (HRB NO.))

A 100 ton plate bearing test and soil investigation was carried out to evaluate runway strength. /IRF/

Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY Republic of Sri Lanka Govt. - Colombo

1.0008, TURBOFAN ENGINE EXHAUST PATTERNS

J.C. WESTKAEMPER, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: This is a continuing study of the decay of exhaust velocity downstream of a 1/30-scale model of a Boeing 747 engine. Velocity surveys have been made in some detail of the near-field flow, for several thrust levels; these data complement earlier far-field data. The results are presently being analyzed in an attempt to correlate them with full scale tests and with existing theories for co-flowing jets without a centerbody.

SUPPORTED BY University of Texas

1.0009, COMPREHENSIVE STUDY OF AIRCRAFT GAS TURBINE ENGINES

G.C. OATES, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105

Description: A comprehensive study of aircraft gas turbine engines is being conducted. An overview of the performance and aerodynamics of aircraft gas turbine engines will be generated. An extensive section, with expert authors providing individual chapters dealing with current advanced problems in the industry, will be written.

Addenda: Estimated calendar year funding reported as 1974 $2,000, 1975 $10,000.

SUPPORTED BY U.S. Dept. of Defense - Air Force

CHEMISTRY AND MATERIALS

Includes Chemistry and Materials (general); Composite Materials; Inorganic and Physical Chemistry; Metallic Materials; Nonmetallic Materials; and Propellants and Fuels.

3.0001, HIGH TEMPERATURE ORGANOMETALLIC COMPOUNDS

S. BROWN, U.S. Army, Gnd. Spt. Equipment Lab., *Huntsville, Alabama* 35809 (DA0C1016)

To prepare a new type elastic material with a high metal content that will act as an adhesive and an insulator for missile structures. It will be capable of resisting high (1000 F) temperatures and will have mechanical properties superior to currently available materials.

The technical approach in this program is to combine a ferrocene- containing monomer with a monomer containing some other metal to yield a stable organometallic polymer.

Supporting agency address information: MICOM Systems Research Directorate, Redstone Arsenal, Al 35809

SUPPORTED BY U.S. Dept. of Defense - Army

3.0002, SYNTHESIS AND CHARACTERIZATION OF REFRACTORY MATERIAL COATINGS PRODUCED BY HIGH RATE PHYSICAL VAPOR DEPOSITION TECHNIQUES

R.F. BUNSHAH, Univ. of California, School of Engineering, *Los Angeles, California* 90024 (DMR75-13347)

This program is aimed at the synthesis and characterization of the select materials using high rate physical vapor deposition technology and specifically, the techniques of direct evaporation (1) and activated reactive evaporation. (1,6) The materials are: TiC-Co, TiC-TiH2, TiC ZrC, TiC-TiB2-Co, and TiC-Ta.

This research has potential technological impact on the solution of problems such as wear of engineering components, cutting tools, metal- working dies, etc., achieved by the application of such coatings to wear surfaces. This work will complement the research of collaborating USSR scientists who are planning to investigate similar systems, such as ZrC- ZrB2 and ZrC-ZrB2-Co. In addition, samples will be exchanged with USSR scientists for characterization by each party.

This project is part of the US-USSR bilateral program in Electrometallurgy.

SUPPORTED BY U.S. Natl. Science Foundation

3.0003, NAVY VEHICLE DESIGN AND CONSTRUCTION - CARBORANES AND POLYMERS FOR ADVANCED MATERIALS

M.F. HAWTHORNE, Univ. of California, School of Letters, *Los Angeles, California* 90024 (DN624212; N00014-69-A-0200-4019)

Foreseeable Navy systems pose complex production problems demanding greater use of plastics and rubbery materials with new combinations of properties including thermal stability beyond the range of known compositions. It is the purpose of this research to provide the chemical means for combining the heat stabilizing influences of carboranes and metals into materials capable of reliable performance in extreme environments such as those projected for advanced Navy weapon systems.

The preparation and properties of novel carboranes and derivatives are investigated. Polyhedral structures containing more than six boron atoms and their transition metal complexes are emphasized as well as the synthesis and characterization of polymers from new carborane monomers.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0004, DEVELOPMENT OF A LOW-COST PROCESS FOR THE FABRICATION OF FULLY DENSE SILICON NITRIDE HIGH-TEMPERATURE GAS TURBINE COMPONENTS

P.J. JORGENSEN, Stanford Research Institute, *Menlo Park, California* 94025 (AER75-14896)

The economics of burning low-Btu gas derived from high-sulfur fuels in combined-cycle power generation plants would become feasible if the gas-turbine inlet temperature could be raised from 1900 degrees F to about 2800 degrees F. The most promising means of attaining an inlet temperature of 2800 degrees F in an industrial gas turbine is by using ceramic materials for hot stage stator and rotor components. If pressureless sintering of silicon nitride to full density could be accomplished, component fabrication costs would be substantially reduced and mechanial performance at high temperatures might be improved.

Pressureless sintering of silicon carbide has recently been accomplished by adding minor amounts of boron and carbon to submicron SiC powder followed by sintering at temperatures in the range 3500-3800 degrees F. The additives decrease the ratio of

grain boundary energy to surface energy, thereby providing the driving force required for sintering. A similar approach should be applicable to the pressureless sintering of silicon nitride. This program will study the effects of a range of chemical additives on the ratio of grain-boundary energy to surface energy for silicon nitride as a function of sintering temperature and additive concentration. Grain growth behavior will be studied and densification kinetics will be established for those additives that reduce the grain boundary energy relative to the surface energy.

SUPPORTED BY U.S. Natl. Science Foundation

3.0005, REFRACTORY OXIDE HEATERS OXIDIZING ENVIRONMENTS

P.A. LARSSEN, Advanced Res. & Tech. Corp., *Newport Beach, California* 92664 (DF242830; F19628-74-C-0147)

AF function - crystals for lasers and other applications. Deficiency - imperfections in refractory oxide crystals due to lack of direct heating elements at crystal growth temperature. Objective - to investigate conductive refractory oxides. How research contributes - present heating of refractory oxides must be done either by (1) a flame or plasma whose stoichiometry is not optimum, (2) an RF source, which introduces thermal strain, (3) a heating element such as graphite or tungsten, which achieves the required temperature but which cannot operate in the oxidizing atmosphere preferred for crystal growth, or (4) thermal imaging, now under development. If conductive oxides were available whose melting points were higher than those of the crystals to be grown, direct heating in the same atmosphere would be possible, with good control of temperature and gradients.

Supporting agency address information: AF Cambridge Research Laboratories LQ, L. G. Hanscom Field, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0006, STRUCTURE AND PROPERTIES OF MATERIALS PREPARED BY PHYSICAL VAPOR DEPOSITION

C.R. BARRETT, Stanford University, School of Engineering, *Palo Alto, California* 94305 (GH-40770)

This is a fundamental study relating structure and properties of materials with controlled microstructure prepared by high rate physical vapor deposition. The particular emphasis of the research is in the preparation and characterization of two phase composite materials where the two phases are mutually insoluble in the solid state. The systems to be investigated include A1-B, Cu-A12O3, and Ni and Ni-Cr dispersed with an oxide phase (ThO2, La2O3, or Y2O3).

SUPPORTED BY U.S. Natl. Science Foundation

3.0007, MATERIALS SUPPORT TECHNOLOGY - STATIC FATIGUE OF CERAMIC MATERIALS

A.G. METCALFE, Internat. Harvester Company, *San Diego, California* 92101 (DN323048; N00014-73-C-0401)

Ceramic materials such as silicon nitride are candidates for use in gas turbine components because of their high-temperature properties (e.g., good oxidation resistance and strength). Other ceramics are fulfilling critical functions in components such as radomes. It is important to define life-limiting properties such as stress corrosion and static fatigue (conditions and mechanisms) to aid in development of materials capable of resisting long term exposure to severe environments. The aim of this program is to establish reliable static fatigue curves for several ceramic materials, especially at high stresses and short failure times.

Delayed failure mechanisms are being determined for silicon nitride (hot pressed and reaction sintered) and alumina (single crystal filament and polycrystalline). Strength is being surveyed at two selected strain rates (in four-point bending) over the range 0-1000 degrees C. Temperature regions over which different strain rate dependent phenomena and environmental effects dominate are to be identified. The effect of selected variables on stress corrosion susceptibility, and static fatigue at conditions of most pronounced stress corrosion will be determined. Small time-dependent effects will be looked for by static load testing. Fracture processes and origins will be investigated microscopically.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0008, NAVY VEHICLE DESIGN AND CONSTRUCTION - THE EFFECT OF DILUTE POLYMER SOLUTIONS ON THE DYNAMICS, AND INHIBITION, OF CAVITATION DAMAGE

A.T. ELLIS, Univ. of California, School of Engineering, *San Diego, California* 92038 (DN623247; N00014-69-A-0200-6004)

The Navy has comprehensive programs of research on cavitation damage, aimed at improving the design, reliability, and performance of ship and machinery elements, such as propellers, shafting, rudders, struts, hydrofoils, hulls and shipboard machinery components. This work contributes directly to the above objective not only by its continuing attempt to clarify and solidify our understanding of the dynamics of cavitation but also by exploring and verifying the significant finding that very dilute polymer solutions may have a large effect in inhibiting cavitation.

Work will continue on theoretical and experimental studies on the dynamics of cavitation damage and on the effect of dilute polymer solutions on inhibiting cavitation. Particular emphasis will be placed on large scale polymer cavitation tests in a 12 inch free surface water tunnel at NUC and on dynamic determination of polymer relaxation times. This experimental data is expected to provide a sound basis for further theoretical work on the use of suitable constitutive equations in mathematical analysis of these polymer solutions.

Supporting agency address information: Office of Naval Research 438, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0009, SOLID PARTICLE IMPACT DAMAGE IN CERAMIC MATERIALS

A.G. EVANS, Rockwell International Corp., *Thousand Oaks, California* 91320 (DN575247; N00014-75-C-0669)

Ceramic materials are used or are being considered for use for components which are contact loaded or particle impact loaded. (examples are IR domes, radomes, laser windows, ceramic bearings and gas turbine parts.) Resultant damage decreases mechanical or electromagnetic performance of such components. Understanding of onset and extent of brittle fracture and plastic deformation of ceramics when loaded in this manner is needed for analysis of modes of failure and materials removal in these materials. Such information will be used to provide part of a basis for understanding impact response and solid particle erosion mechanisms in ceramics. This will provide rational direction for development of erosion resistant materials via modification of microstructural features.

Materials under study include soft ones (KBr, KCl, NaCl), hard ones (hot pressed silicon nitride and silicon carbide, reaction bonded silicon nitride, a glass-ceramic, etc.), and intermediate materials (e.g., ZnSe, CaF2, MgF2). Indentation: spherical and sharp quasi-static indentation studies will be done to explore the sequence of (deformation and cracking) damage events as load magnitude; duration and (microstructural) location are varied. Strain rates will be varied. Impact: instrumented impact studies will be performed as a function of impact velocity. Single particle impact will include velocity, projectile size and loading angle. Damage, strength degradation, and correlations with indentation studies will be determined. Analyses: median vent and lateral vent formation and propagation will be correlated with analytical studies. Analysis of extent of deformation expected in soft materials, and slip systems necessary to produce shape change under the indenter are to be done. Microscopy and acoustic emission will be used to study cracking and deformation events.

Supporting agency address information: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0010, COMMUNICATIONS - RARE EARTH GALLIUM PEROVSKITE SUBSTRATES FOR BUBBLE DOMAIN IRON PEROVSKITES

S. GELLER, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (DN223864; N00014-67-A-0405-0005)

This work is concerned with the development of improved substrates for epitaxial magnetic films with bubble domains for logic and memory devices useful to the Navy in its communications and surveillance operations.

It is proposed to grow improved rare earth gallium perovskite substrates for bubble domain iron perovskites using the Czochralski technique. While garnet materials, grown by liquid phase epitaxial growth or by chemical vapor deposition is now favored for magnetic bubble technology the perovskites have promising properties. They have higher domain wall mobilities than the garnets although the domains are larger. With improved substrates it may be possible to diminish the size of the domains to make the perovskites a superior bubble material.

Supporting agency address information: Office of Naval Research 421, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0011, SILICON NITRIDE-TANTALUM COMPOSITES FOR TURBINE COMPONENTS

J.J. BRENNAN, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DN590011; N62269-74-C-0359)

To develop Si3N4 matrix composites reinforced with tantalum fibers for gas turbine components such as vanes operating at temperatures of 2400 F and above.

Hot pressed Si3n4 matrices reinforced with 25 volume percent of tantalum fibers are being developed for improved resistance to impact loads. Mechanical properties and thermal stress resistance of the composite are being evaluated under conditions simulating gas turbine requirements.

Supporting agency address information: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0012, PRESSURELESS SINTERED SIALON CERAMICS

M. DECRESCENTE, United Aircraft Corporation, *Hartford, Connecticut* 06118 (DN590019; N00019-75-C-0232)

To develop processes for pressureless sintering of high strength sialon ceramic gas turbine components.

Starting materials will be selected from various components, such as Al203, Si3N4, AlN, Si02 and other precursor materials including salts, gels, or organometallics. Investigation will be made of processing parameters such as sintering temperature, time, atmosphere, starting material particle size, and pre-sintering homogenization schedules.

Supporting agency address information: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0013, MATERIALS SUPPORT TECHNOLOGY - INFRARED TRANSMITTING CHALCOGENIDE WINDOWS

P.B. MACEDO, Catholic University of America, School of Engineering, *Washington, District of Columbia* 20017 (DN223485; N00014-67-A-0377-0017)

New and improved materials are needed as windows for high power carbon dioxide laser systems. Candidate materials include chalcogenide based glasses (i.e., containing sulfur, selenium or tellurium) and crystallized glass-ceramics. Research is needed to allow development of high-strength, low optical loss infrared (IR) transmitting materials of this kind intended for such systems. Major emphasis is on (1) reduction of the absorption coefficient at 10.6 micrometers to 0.001 per cm due to oxygen impurities, (2) determination of absorption by other mechanisms and (3) tailor-making a new type of chalcogenide glass-ceramic material (a two-phase partially crystalline composite).

Small amounts of Ge or Sb will be added to As2Se3 glass to try to move impurity bands away from 10.6 microns. Hydrogen impurity bands will also be investigated (nature, source, elimination). Multiphonon band splitting by partial replacement of constituents such that the intensity will be spread toward longer wavelengths will be attempted. Thus, IR spectra of chalcogenide glasses in which two or more types of nearest neighbor bonds are expected will be investigated. Temperature dependence of multiphonon bands will be determined to see if absorption in As2Se3 glass near 10.6 microns is due to a 4-phonon band or to an impurity band. Attempts will be made to assess transparency limits of chalcogenide glasses in the IR window region.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0014, MATERIALS SUPPORT TECHNOLOGY - PIEZOELECTRIC EFFECT IN PERMANENTLY POLARIZED INORGANIC GLASSES AND GLASS-CERAMICS

J.H. SIMMONS, Catholic University of America, Graduate School, *Washington, District of Columbia* 20017 (DN575280; N00014-75-C-0707)

The Navy uses underwater acoustic transducers in a variety of applications such as sonars and hydrophones. The active materials of greatest use for the past thirty years generally have been of the piezoelectric polycrystalline ceramic variety ('PZT's'). Limitations with presently used materials and hopes for new capabilities in the future make it desirable to have materials with a broad range of properties available for a desired application (e.g. low coefficient of expansion, tailorable modulus, low porosity, high durability, high Curie temperature. The scientific goals of this work are to form intrinsic or barrier electrets from polarized phase separated glass and glass- ceramics and to evaluate and optimize piezoelectric effects in these materials.

Inorganic glasses of varying compositions are to be prepared. Microstructure and phase separation will be characterized. Dielectric behavior and electrical polarization will be measured as temperature and composition are changed. Piezoelectric measurements including effects of cyclic loading will be made. Further developments of piezoelectric glass electrets and glass-ceramic electrets will be done.

Supporting agency address information: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0015, ANOMOLOUS RADIATION INDUCED CURRENTS IN FERROELECTRICS

P.S. BRODY, U.S. Army, Harry Diamond Laboratories, *Washington, District of Columbia* 20310 (DA0D5736)

The objectives of this program are to examine current outputs from ferroelectrics (photo-currents) exposed to light and eventually extend this examination to the X-ray range.

Light induced currents and voltages from BaTi-alpha-3 and PZT ceramic and BaTi-alpha-3 single crystal will be examined as a function of polarization intensity, wave length and electrode placement etc. A hypothesis will be formed to explain the mechanism for the observed properties.

Supporting agency address information: AMC Harry Diamond Laboratories, Washington, D.C. 20438

SUPPORTED BY U.S. Dept. of Defense - Army

3.0016, SOFT X-RAY SPECTROSCOPY

J.R. CUTHILL, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3120122)

Soft X-ray and X-ray induced photoelectron emission spectra are being obtained, giving valence band electron density of states and core level width and shift information. Current studies are on metals and alloy systems that are related to the energy program, including the transition metals, their alloys with each other, transition metal carbides, and rare earth-transition metal compounds that are of interest in various of the facets of the energy program, such as catalysis, hydrogen storage, permanent magnets, and superconductivity.

Data is being obtained on these metals and alloys with a view toward advancing the understanding of alloying behavior and parameters responsible for their properties.

The primary objective is to exploit the combination of soft X-ray spectroscopy and soft X-ray photoelectron spectroscopy as a means of obtaining valence band density-of-states information and core level shifts with a view toward advancing the understanding of the basic principles of alloying behavior. The aim is to provide guideposts to the tailoring of alloys for specific applications. Currently, our immediate objective is to obtain both core level and valence band information on alloy systems that have promise of functioning in various energy program related capacities such as catalysts, hydrogen storage media, and superconductors. To maintain a state-of-the-art posture in soft X-ray spectroscopy, a field where standard commercial spectrometers are not available, we necessarily have as a co-objective the continual development of soft X-ray spectroscopy instrumentation.

The electronic structure is recognized as an important factor in the catalysis process and in superconductivity, and we believe it to be important in the hydrogen storage mechanism also. We can expect that the facet of our economy that is involved, say, in the development of commercial catalysts, will be interested in the type of electronic structure parameter information that we are getting. One such parameter is the electronic density of states at the Fermi energy, N(EF). We hypothesized that high catalytic activity is associated with high N(EF) and low catalytic activity is associated with low N(EF). A careful study of the valence band of Pt by soft X-ray induced photoelectron emission, XPS, and soft X-ray spectroscopy, SXS, which we published, indeed showed Pt to have a high N(EF). (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

3.0017, SEMICONDUCTORS AND INSULATORS
W.R. HOSLER, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3130172)

This project deals with the optical and electrical characteristics of oxides and halides. The purpose is to obtain measured values and understanding of physical parameters needed for technological applications (e.g., materials for MHD-power generators, for catalytic processes, and for (opto-) electronic devices).

Objective: To measure the electrical and optical properties of oxides and halides in bulk and at interfaces.

Motivation: To provide data on materials of importance a) for power generation b) in catalytic processes

Approach: Experimental and theoretical studies of the electrical and optical properties of oxides and oxide surfaces over a wide temperature range.

Progress: Optical Properties of LaCrO3 and (LaCa)CrO3: Photoluminescence and excitation, diffuse reflectivity and photoconductivity of LaCrO3 and La1-xCaxCrO3 (x equals 0.1, 0.2, 0.3) were measured. In the range 1.6-3.5 eV luminescence and reflectivity spectra typical of 6-coordinated Cr3 ion were observed. Absorption and photoconductivity indicate that the O equals - Cr3ion transfer energy (band gap) is larger than 5.4 eV. Conductivity data in the range 77 - 300 K show an activation energy of 0.2 eV.

Electrical conductivity of SrZrO3 with Ce or Ti dopants: Searching for electronically conducting MHD electrode materials, a study was made of the electrical properties of SrZrO3 doped with 14% CeO2 (A) and SrZrO3 3 ion doped with 6% SrTiO3 and 1.5% Ta2O5 (B) the purpose of this doping was to produce Ce and Ce4 ion in the former or Ti3 ion and Ti4 ion in the latter. Electrical measurements (both D.C. and A.C.) indicate activation energies of 4.0 and 3.6 eV respectively. The conductivity at 1700 degree C is about 0.1 ohm-1cm-1 in both cases. The latter value is acceptable for MHD electrodes at that temperature; unfortunately the steep slope makes it less appropriate in the 1000-1500 degree C range. SiO2 on Si by infrared relection spectroscopy: Spectroscopic equipment was assembled for the recording of the spectra of thin oxide films on silicon substrates. The glancing angle reflectivity technique (70 degrees to normal) appeared to be the most sensitive method. Measurements were made on 'natural' SiO2 films on Si (50 angstrom units; atmospheric pressure) and on thicker films. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

3.0018, FRACTURE CHARACTERISTICS OF METALS
T.R. SHIVES, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3120118)

This project entails the correlation of fracture features primarily of cast alloys and sintered carbide type cutting tool materials with modes of fracture. Characterization will be done principally by optical and scanning electron microscopy. The results will be useful for service failure analysis and in gaining a better understanding of fracture.

Objective: The objective of this project is to characterize the fracture surfaces of various classes of materials such as cast alloys and sintered carbide type cutting tool materials and to correlate fracture features with various modes of fracture.

Motivation: While there is a considerable amount of fractographic data available for wrought alloys, there is very little available regarding cast alloys and sintered carbide type cutting tool materials. The information derived from a study of the fractures in these materials will be very valuable to those involved in fractography--from the study of fracture mechanisms to the more applied service failure examinations. The results will be an invaluable source of information for the service failure investigations carried out in the NBS Mechanical Properties Section. These investigations are done for various agencies, a few of which are the Bureau of Aviation Safety, the Office of Pipeline Safety, the Federal Railroad Administration, and the Office of Hazardous Materials. A better understanding of a service failure may lead to increased safety and better performance for components in future applications similar to those that produced the failure.

Approach: Specimens of selected classes of casting alloys and sintered carbide type cutting tool materials will be fractured under known conditions and in specific modes such as bending fatigue, tensile overload, etc. The fracture surfaces so produced will be examined primarily by optical and scanning electron microscopy in order to correlate fracture features with fracture mode.

Progress: Due to increased service failure analysis work for other government agencies, no direct work has been done on the project during the last fiscal year. Some data have been collected indirectly from some of the failure analyses which will be drawn upon for later work.

Plans: It is anticipated that the characterization of the fracture features of selected sintered carbide type cutting tool materials and cast aluminum alloys will be started in the current fiscal year.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

3.0019, FRACTURE OF BRITTLE MATERIALS
S.M. WIEDERHORN, U.S. Dept. of Commerce, Inorganic Materials Division, *Washington, District of Columbia* 20230

Description: 1) Objective: To develop techniques and procedures for failure prediction in structural ceramic materials for use at elevated temperatures. 2) Motivation: The structural reliability of ceramic materials in high temperature applications. This work is needed to obviate the problems of premature failure typically observed in structural ceramic components which have not been subjected to a prior non-destructive test procedure. The results will be specifically applied to high temperature gas turbines for military and public use, e.g., for aircraft, power generation, and automobiles; but they will also be more generally applicable to any high temperature structural application for ceramic materials (such as bearings, furnace linings, etc). The work will permit turbine temperatures to be substantially increased, thereby leading to considerable increases in efficiency. 3) Approach: Crack propagation rates in the candidate materials, Si(3) N (4) and SiC, are being studied at the anticipated turbine operating temperatures (1100 degrees C to 1500 degrees C). The crack growth rates are used to predict the stress/lifetime capabilties. The lifetime information is used for materials development and failure prediction purposes. The potential of overload-proof testing and acoustic emission as effective non-destructive evaluation techniques is also being explored. 4) Progress: Crack propagation rates have been measured on several silicon nitrides and one silicon carbide, and the corresponding lifetime predictions formulated. Acoustic emission during crack propagation has also been monitored and correlated with the crack growth rate. Overload proof test diagrams, based on the crack propagation data, have been developed.

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0020, FRICTION AND WEAR OF CERAMIC MATERIALS
S.M. WIEDERHORN, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Washington, District of Columbia* 20234 (3130453)

This project was initiated to generate friction and wear data on ceramic materials in order to clarify the wear mechanism of these materials. Applications of this data are in the area of finishing and grinding of ceramic materials and in the area of friction and wear of bearing materials. Initial studies were conducted on effect of normal alcohols on the abrasion and wear of glass since it had been reported previously that these alcohols have an extraordinary effect on drilling of glass, increasing the drilling rate by as much as 20 times.

Objective: To generate information on the friction and wear of alumina, silicon nitride and silicon carbide to better understand these processes in ceramic materials.

Motivation: Used in military and commercial applications, silicon nitride, silicon carbide and alumina are finished by abrasion and are used in areas where hardness and wear resistance are important. Therefore, the wear properties of ceramic materials and how these properties might be controlled are of commercial and military importance. Information gathered will apply to ceramic finishing, the development of better materials for gas bearings, and the development of better ceramic tools and abrasives.

Approach: The friction and wear of ceramic materials are measured under a variety of conditions. Simultaneously, the surface and subsurface damage introduced by the wear are characterized by optical and electron microscopy techniques. Studies are conducted with temperature, environment, and material composition as variables.

Progress: An investigation has been completed on the effect of normal alcohols on the friction and wear of glass. Measurements of the wear rate and friction and soda lime silicate glass spheres abraded against silicon carbide in various normal alcohols indicated that wear is most strongly affected by water and the low chain length alcohols, and effect opposite that observed for drilling. Environment also affected the mode of chip formation in the glass surface, the rate of clogging of the abrasive surface with debris, and the degradation of the abrasive surface due to pull out of the cutting points. These data have been satisfactorily explained by the classical theories of abrasion and wear.

Plans: These studies will be extended to other materials: silicon carbide, silicon nitride, and aluminum oxide. (Text Abridged)

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

3.0021, STRONGER CERAMIC SONAR TRANSDUCER MATERIALS
R.W. RICE, U.S. Navy, Research Laboratory, *Washington, District of Columbia* 20390 (DN220020)

To improve the strength of PZT ceramic transducer materials in order to achieve more reliable operation and lower maintenance costs of transducers.

The basic approach is to (1) determine the mechanisms of fracture and their dependence on microstructure (including impurities and additives) and, in turn, to assess the dependence of microstructure on processing, and (2) investigate methods of strengthening PZT ceramic without significantly impairing relevant piezoelectric properties.

Supporting agency address information: Office of Naval Research 468, Arlington, Virginia 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0022, REACTION-SINTERED SILICON NITRIDE AS A RADOME MATERIAL
J.D. WALTON, Georgia Inst. of Technology, Engineering Experiment Station, *Atlanta, Georgia* 30332 (DN590042; N00019-75-C-0372)

To study the processing technology needed to fabricate missile radomes of reaction-bonded silicon nitride.

Two different lots of silicon powder will be characterized, then used for a study of milling, ship casting, isostatic pressing, and injection molding prior to reaction sintering. Machining and surface sealing will be studied. The resultant silicon nitride bodies will be characterized for electrical, physical, mechanical, and thermal properties. Two radomes five and one half inches in base diameter and thirteen inches long will be fabricated.

Supporting agency address information: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0023, SULFUR IN THE CORROSION OF SUPERALLOYS 11842-MS
J.B. WAGNER, Northwestern University, School of Technology, *Evanston, Illinois* 60201 (DA0D9273; DAHC04-74-G-0130)

To study the rate and the mechanism of diffusion of sulfur in mono- and polycrystalline oxides of transition metals, with and without minor additions that will modify the abundance of crystalline defects (e.g., Cr sub 2 alpha sub 3 or Li sub 2 alpha added to NiO). Relevance - the corrosion of gas turbines, e.g., in aircraft, is intensified by the presence of sulfur in the fuel. Army technologists have voiced the need of a fundamental study of reactions of refractory metals and alloys with gases at the temperature of gas-turbine blades. Knowing how sulfur passes through the protective oxide on the blades is a vital part of understanding the whole destructive interaction.

Experiments will include- 1) measurement of the diffusion of (35)S in doped and undoped single crystals of nickel oxide, and Cr sub 2 alpha sub 3, and in hematite (Fe sub 2 alpha sub 3); 2) measurement of the diffusion of (63) Ni in mono-crystalline nickel oxide doped with sulfur; 3) determination of the soulubility of sulfur in nickel oxide; 4) study of sulfur-doped nickel oxide by electron spectroscopy (ESCA); and 5) study of the sulfidation of metals and alloys by SO sub 2/alpha sub 2 mixtures.

Supporting agency address information: OCRD Army Research Office, Box CM, Duke Station, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

3.0024, NAVAL VEHICLE DESIGN AND CONSTRUCTION - STRUCTURE DETERMINATION OF SOLID MATERIALS FOR NAVY USE
H.S. GUTOWSKY, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801 (DN223738; N00014-67-A-0305-0023)

A knowledge of the properties of solid materials and how they relate to the microscopic structure of these materials is of importance to the Navy in its pursuit of solids with improved characteristics such as stability to heat and radiation. It is proposed to study the structure of solids and the dynamic processes occurring within solids, such as molecular rotations and diffusion, by means of nuclear magnetic resonance techniques.

Pulsed nuclear magnetic resonance experiments will be carried out on solids such as TaF7, NH4PF6, and NH4BF4 to determine the nature of rotational and diffusional motions of the groups in the solid and how these motions change with temperature. The investigation will also include line shape studies and chemical exchange studies of solids.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0025, RESEARCH INITIATION - LIQUID PHASE SINTERING OF DIPHASIC DIELECTRIC CERAMIC MIXTURES
D.A. PAYNE, Univ. of Illinois, Graduate School, *Urbana, Illinois* 61801 (DMR75-10327)

This research on liquid phase sintering of diphasic dielectric ceramic mixtures will investigate densification kinetics of liquid phase sintering in model systems, such as BaTiO3-NaNbO3. A basic dilatometric approach will be used to determine the stages of densification. Curie- Weiss Analysis will also be employed for characterizing (Ba, Na) (Ti, Nb)3 compound formation in the latter stage of sintering. Grain size and phase distributional analysis will be used to develop a physical model by which dense fine grain (1'm) ceramic mixtures may be prepared without incurring

any significant grain growth. Several investigations with lower melting point additions will be included, e.g., Pb5Ge3O11, Bi2WO6, NaNbF6, to determine if sintering temperatures for BaTiO3 may be substantially reduced to conserve fabrication energy.

SUPPORTED BY U.S. Natl. Science Foundation

3.0026, DYNAMIC FINITE PLASTICITY AND HIGH ENERGY FORMING OF METALS
L.H. LEE, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (ENG72-04178 A01)

This research program is concerned with the further development and application of a number of concepts and principles in dynamic finite plasticity for solving problems in high energy forming of metals.

Specifically, the following studies will be pursued: (1) To analyze the effects of boundary constraints and the problem of spring back in high energy forming of circular blanks. (2) To develop the bifurcation criterion for investigating problems of instability in forming of metals. (3) To investigate the dynamics of an axisymmetric elastic-plastic body at large strain and deformation. (4) To study the problem of dynamic forging of axisymmetric bodies, including the effects of lateral inertia and shear on wave propagation.

SUPPORTED BY U.S. Natl. Science Foundation

3.0027, FIRE AND SMOKE SPREAD
J.L. NOVOTNY, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (ATA73-07749 A01)

Current action provides additional funding and extends the duration of award number GI-37191. The primary objective is to provide the foundation for the development and the use of theoretical predictions for describing fire and smoke spread in corridors. The theoretical predictions are based on a global approach as well as preliminary first principle calculations for a single corridor. The analyses will be highly coupled to small-scale experiments as well as to full-scale experiments. The small-scale experiments, which will be carried out at Notre Dame, will provide valuable insight into not only the development of the first principle analysis but also will be used to judge its utility for future applications. Full-scale data from the National Bureau of Standards corridor facility will be employed. This includes existing data in addition to future data gathered with supplementary instrumentation. The full-scale data will be compared to the global analysis, as well as used for input to the first principle formulation. Finally, the approaches will be evaluated in terms of their potential for providing meaningful information in the spread problem, including application to the ASTM E-84 tunnel.

SUPPORTED BY U.S. Natl. Science Foundation

3.0028, HIGH-TEMPERATURE CHEMISTRY
P.W. GILLES, Univ. of Kansas, School of Liberal Arts, *Lawrence, Kansas* 66044 (AT(11-1)-1140)

The goals of the research are to establish the compositions and structures of high-temperature substances and to measure the thermodynamics and kinetics of their high-temperature reactions. The reasons for the research lie in the increasing demand for high- temperature materials and their thermodynamic data especially in fields related to energy conversion, in the theoretical and bonding implications of the thermodynamic results for gaseous substances which can be obtained only from high-temperature studies, in the new substances which can be prepared only by high-temperature techniques, and the unique contributions that high-temperature studies can make to the elucidation of the thermodynamic properties of transplutonium compounds which can be obtained only in minute quantities.

Vaporization studies on refractory binary and ternary systems of oxides, borides, and sulfides will be accomplished through Knudsen effusion, torsion effusion, and mass spectrometric techniques. Complex inorganic gaseous substances will be studied mass spectrometrically. Kinetics of vaporization will be investigated by measuring the effect of the degree of saturation on the rate of vaporization of single crystals, by using a spherical effusion cell and quadrupole mass spectrometer. Modulation of the neutral beam will be used to investigate the degree of fragmentation of high-temperature substances in a mass spectrometer.

Results: During the past year three papers were published on the high-temperature properties of rare-earth sulfides, ternary gaseous oxides, and on the high-temperature role of vaporization studies and mass spectrometry. Two additional experiments were performed on the vaporization of Ti3O5. In order that minicomputers can be used as instruments, not as calculators, many programs were written.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0029, SELECTIVE REINFORCEMENT OF ALUMINUM-GRAPHITE STRUCTURAL SHAPES
R. PEPPER, Fiber Materials Incorporated, *Briddeford, Maine* 04005 (DA0F4732; DAAG46-75-C-0060)

The objective is to demonstrate the feasibility of selectively reinforcing four commercially available aluminum structural I beams with high-performance aluminum-graphite composites. The strength of the reinforced I beams will be measured and compared with their unreinforced counterparts.

Composite laminates 4 inches by 0.5 inches by 0.125 inches will be fabricated by solid state and solid and liquid state bonding of two ply 6061 Al thornel 50 wire and evaluated for mechanical strength and structural integrity. Using the best of the two fabrication methods, composite laminates 0.04 inches thick will be bonded to 3 inches by 2.59 inches wide flange 6061 aluminum I beams. After sound, high-quality bonds have been achieved between the Al/graphite laminate and the Al I beam flange, four 6061 Al (3 inches by 2.59 inches) wide flange I beams each having a length of 20 inches will be reinforced by bonding Al/graphite laminates 0.04 inches thick to their flanges and delivered to AMMRC with four similar unreinforced I beams for evaluation and demonstration of the concept of selective reinforcement.

Supporting agency address information: AMC Materials and Mechanics Research Ctr, Attn-AMXMR-EM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0030, CEMENTED ALLOY CARBIDES FOR HARD ROCK BORING
J.A. GREEN, Martin Marietta Corporation, *Baltimore, Maryland* 21227 (ATA74-21441)

Martin Marietta Laboratories will conduct research on superior carbide-based cutting tool materials for rock boring applications. To accomplish this objective, emphasis will be placed on improvement of the properties of the hard carbide phase by alloying and on developing compatible binders. Previous work has demonstrated that considerable control can be exercised over the mechanical behavior of the carbides through the appropriate choice of alloying constituents selected on the basis of an understanding of the nature of atomic bonding interactions. This effort has led specifically to the preparation of (Ti,V)C alloy carbides having remarkable properties that appear highly desirable for cutting tool materials. Martin Marietta Laboratories will produce (1) a cemented alloy carbide cutting tool material incorporating an alpha(Ti,V)C alloy hard phase and a compatible binder selected according to its suitability for rock boring applications, (2) several other carbide alloys selected on the basis of prior results and incorporate them in suitable binders, and (3) test and evaluation procedures for these materials under simulated and real rock boring conditions. It is expected that the results will show that cemented alloy carbides of this type can be exploited to obtain significant increases in cutter and bit life that will have a direct impact on rock boring costs and efficiency.

SUPPORTED BY U.S. Natl. Science Foundation

3.0031, INVESTIGATION OF THE FAR INFRARED PROPERTIES OF METALS AND SEMI-METALS
H.D. DREW, Univ. of Maryland, School of Arts, *College Park, Maryland* 20740 (DMR73-023908 A01)

Experimental investigations of the far infrared properties of metals, semi-metals and narrow gap semiconductors supported by NSF Grant DMR-7302398 will be continued. The measurements of the new excitonic effects in bismuth will be extended to higher fields and to higher frequencies using 2nd harmonic absorption with H2O and D2O vapor lasers. Spin resonance and its coupling to the excitonic modes will be studied in bismuth. Other investigations include studies of lifetime effects in the plasma edge of bismuth, studies of electron-electron and electron- phonon interaction in cyclotron resonance in nickel and a continuation of the optical studies of graphite and PbTe in the far infrared.

SUPPORTED BY U.S. Natl. Science Foundation

3.0032, SOLUTION GROWTH

C.O. DUGGER, U.S. Air Force, Cambridge Research Labs., *Bedford, Massachusetts* (DF279650)

AF function - surveillance, detection, etc. Deficiency - current electroacoustic devices represent the use of first generation materials and more efficient, high acoustic velocity materials are required. Research - to develop a reliable, reproducible method for the growth of aluminum nitride the highest acoustic velocity material known and other advanced electroacoustic materials. Aluminum nitride and other electroacoustic materials are to be fabricated as single crystal thin films. These films are necessary for components of microwave frequency surface wave devices. How research contributes - the device use of aluminum nitride thin films can only be optimized by performing tensor analysis on bulk (10 mm cube) aluminum nitride single crystals. Once the physical properties of aluminum nitride are known, it will be possible to calculate those quantities relevant to surface wave devices, such as, the piezoelectric and dielectric constants, the propagation velocities and dispersions as a function of film thicknesses and crystal orientations. Surface wave acoustic devices are used as microwave amplifiers, signal analyzers, microwave memories, and as other communication devices.

Supporting agency address information: AF Cambridge Research Laboratories LQ, L. G. Hanscom Field, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0033, NAVY VEHICLE DESIGN AND CONSTRUCTION - STRUCTURE AND PROPERTIES OF MODEL COMPOUNDS FOR HEAT RESISTANT PLASTICS AND RUBBERS

W.N. LIPSCOMB, Harvard University, School of Arts, *Cambridge, Massachusetts* 02138 (DN524287; N00014-67-A-0298-0018)

Superior plastic and rubbery materials in many forms are needed to solve complex fabrication problems of advanced Navy weapon systems such as F14 aircraft. It is the purpose of this research to provide the chemical theory needed to guide the development of new families of materials such as the promising new carborane-based high-temperature elastomers.

New theoretical methods, advanced experimental structure determining techniques and analytical processes are developed and applied to frontier problems of complex molecule chemistry. Current studies deal with boranes, carboranes, transition metal complexes of boron and other inorganic compounds. Molecular orbital calculations, X- ray diffraction data are used with combinations of other chemical and physical methods to contruct general theories for thermal rearrangements and reactivity in polyhedral boron chemistry.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0034, SYNTHESIS OF ORGANOFLUORINE COMPOUNDS BY DIRECT FLUORINATION

R. LAGOW, Mass. Inst. of Technology, School of Science, *Cambridge, Massachusetts* 02139 (DF038800; AF-AFOSR-2691-74)

There is a need for new approaches to the synthesis of high molecular weight polymers specifically tailored in molecular structure so they will exhibit broad temperature range viscoelasticity by virtue of their low glass transition temperature stabilities. This research is aimed at the utilization of a direct fluorination technique for the conversion of organic compounds, particularly oxygen-containing organic compounds of multiple functionalities. The synthesis of perfluorinated monomers proposed should lead to new fluorocarbon elastomers, polymers, low- and high-temperature greases, seals, sealants, coatings and/or insulation materials of interest to the Air Force.

Supporting agency address information: AF Office of Scientific Research NC, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0035, DEFECT AGGREGATION IN IRRADIATED MATERIALS

K.C. RUSSELL, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DMR73-07609 A01)

The theory for void nucleation already developed will be used to simulate first wall swelling for various proposed CTR burn cycles. The theory is uniquely capable of considering transient effects, and the effects of transmuted gaseous and non-gaseous impurities. Calculations will be based on material constants of 316 stainless steel, the mean probable flux-time-temperature burn cycles, and best estimate of transmutation and displacement rates. This investigation is expected to identify conditions where first wall swelling is particularly severe. Irradiation may produce non-equilibrium microstructures by various mechanisms. A quantitative theory is being developed to describe the 'chemical' effect of excess defects on the stability of incoherent or partly coherent precipitates. The theory will be applicable to ternary alloys and interstitial solates, and will be used to model precipitate instability first in the Al-Si system, and then of carbides in stainless steel cladding alloys. The thrust of the program is to predict phase instability.

This is a renewal of NSF Grant DMR7307609.

SUPPORTED BY U.S. Natl. Science Foundation

3.0036, FABRICATION OF GRAPHITE PREFORMS

E. SHOFFNER, Fiber Materials Incorporated, *Graniteville, Massachusetts* 01829 (DA0E4703; DAAG46-73-C-0007)

To fabricate 3-dimensional orthogonal graphite preforms, densified with a carbon matrix, for testing purposes.

Thirteen 2x2x6 inch orthogonal 3-dimensional graphite billets will be woven using thomel 60 and thomel 400 graphite fibers. The billets will be densified by resin impregnation.

Supporting agency address information: AMC Materials and Mechanics Res Ctr, AMXMR-RD, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0037, RESPONSE OF POLYMERS TO HIGH-INTENSITY HEAT

E.T. WALDRON, U.S. Army, Natick Laboratories, *Natick, Massachusetts* 01760 (DA0D4342)

To determine the role of thermo-physical properties of polymers in their response to high-intensity heat to aid in the selection of materials for the design of thermal protective clothing.

Conduct heat flow studies on polymer film and fabric systems, employing the selas burner and coherent and high energy sources. Additional thermal parameters necessary to interpret test data will be obtained by differential scanning colorimetry (DSC) and thermogravimetric analysis (TGA).

Supporting agency address information: TROSCOM Natick Laboratories, Natick, Ma 01762

SUPPORTED BY U.S. Dept. of Defense - Army

3.0038, CASTING OF HALIDE AND FLUORIDE ALLOYS FOR LASER WINDOWS

D. READEY, Raytheon Company, *Waltham, Massachusetts* 02154 (DF278910; F19628-74-C-0148)

AF function - laser weapons systems. Deficiency - inability of conventional window materials to passively withstand power of laser. Objective - to investigate casting as a method of fabricating potassium chloride and alkaline earth fluoride laser windows.

How research contributes - potassium chloride is a prime candidate for a 10.6 laser window if blanks of sufficient size and mechanical strength can be produced while maintaining low optical absorption. Casting techniques may be easily scaled up in size, but present castings exhibit a considerable degree of residual strain. This contract will investigate casting and annealing procedures to eliminate strain. Alkaline earth fluorides are suitable materials for windows in the 3 to 5 micron range. Casting is a technique ideally suited to making large window blanks. Castings of these materials will be evaluated for optical quality in the 3 to 5 micron range and mechanical strength.

Supporting agency address information: AF Cambridge Research Laboratories LQ, L. G. Hanscom Field, Bedford, Mass. 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0039, CHARACTERIZATION OF INTERMEDIATE COMPOUNDS IN THE SYSTEM TITANIUM-BORON

W.J. CROFT, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4768)

To prepare and characterize such little known materials as titanium borides, particularly the off-stoichiometry effects in titanium monoboride and titanium diboride. To characterize a variety of materials in the complex silicon-nitrogen-oxygen and/or carbon systems. To characterize materials having unusual elastic properties in the copper- aluminum alloy system. To correlate fundamental physical and mechanical properties of such materials in relation to their application as erosion, wear and corrosion resistant coatings, high-temperature ceramic components, and components requiring unusual elastic properties. To evaluate materials for protection against high-energy lasers.

Compounds will be prepared by a variety of methods to give the most useful properties. Characterization will employ principally microscopy and diffraction techniques supplemented by any other procedures required to fully understand the materials. Actual materiel components will be coated to evaluate the problems to be expected.

Supporting agency address information: AMC Materials and Mechanics Res Center, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0040, MECHANICAL BEHAVIOR OF ALUMINUM-GRAPHITE COMPOSITE MATERIALS

T.S. DESISTO, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4699)

The objective of this program is to evaluate the fatigue, fracture, stress corrosion, and strength properties of aluminum-graphite metal matrix composite materials as a function of fiber orientation. Metal matrix composites have been proposed for use in several Army aircraft applications, including wing, fuselage, transmission housing, and drive shaft. Strength and crack growth resistance both parallel and perpendicular to fiber orientation require study to determine failure modes and soundness of fiber/matrix bond.

The tensile properties, fracture toughness, fatigue behavior, and stress corrosion susceptibility of aluminum-graphite composites will be investigated for material produced by current state-of-the-art techniques. Properties will be determined for both transverse and longitudinal orientations for unidirectional fiber reinforcement. Failure modes as a function of orientation and processing will be characterized.

Supporting agency address information: AMC Materials and Mechanics Research Cen, Attn-AMXMR-EM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0041, OSTWALD RIPENING IN DISPERSION-STRENGTHENED CERAMICS

S.K. DUTTA, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4767)

To study Ostwald ripening effect in Si-B4C and Si-SiC systems. This program will provide better understanding of particle coarsening phenomena, which would make significant contributions in developing satisfactory microstructures in the above systems with improved properties in the fabricated materials.

Phase equilibrium relationships and the wetting behavior will be studied from microstructures in the Si-B4C and Si-SiC systems. Quantitative metallographic techniques such as dihedral angle measurements, solid-solid/solid-liquid ratio, direct bonding, etc., will be utilized to determine the extent of grain growth, solution, and reprecipitation of the dispersed phase in the matrix. Size distribution, mean size, and number of particles per unit volume will be determined by transmission microscopy.

Supporting agency address information: AMC Materials and Mechanics Research Ctr, AMXMR-EO, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0042, CONTROL OF EXAGGERATED GRAIN GROWTH IN SILICON CARBIDE BY RATE CONTROLLED SINTERING AND ITS EFFECT ON HIGH TEMPERATURE PROPERTIES

S.K. DUTTA, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4701)

Silicon carbide possesses the high strength and thermal shock resistance to make it a candidate material for ceramic turbine rotors and secondary metal processing components such as extrusion dies. To perform these roles, a method for easy fabrication of SiC via pressureless sintering is required. In SiC formed by pressureless sintering to date, exaggerated grain growth has been a problem. This project will address the development of a technique for controlling exaggerated grain growth and to produce fine-grained, theoretically dense SiC bodies for the above applications.

Isostatic cold forming followed by rate-controlled sintering and rate-controlled pressure sintering to aid in defining grain growth lower limits. In both cases, particular attention will be focussed on different heat cycles to be imposed on the specimens including a step- heating approach.

Supporting agency address information: AMC Materials and Mechanics Research Ctr, Attn-AMXMR-EO, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0043, STRENGTHENING MECHANISMS IN NICKEL-BASE SUPERALLOYS

R.D. FRENCH, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4798)

To investigate mechanism for strengthening and improving creep resistance in superalloys. Emphasis will be given to the role of carbides in changing strength and ductility. In prior years, the morphology of MC carbides in nickel-base alloys has been examined to determine the extent of connectivity and to relate morphological developments to specific thermal treatments. It has been shown that changes in strength and ductility accompany these morphological changes. This project supports problem areas 14.1 and 15.1 of the materials technology plan for aircraft, guidance for FY75. In addition, this project directly supports the analyses of fracture in nickel superalloys.

This project will examine the role of secondary phases in strengthening nickel base superalloys. Attention will be directed at those phases which have a primary role in high temperature strengthening although first efforts will be directed at determining the effects of those phases on room temperature strength and ductility. Specimens will be subjected to appropriate thermal treatments to alter the minor phases.

Supporting agency address information: AMC Materials and Mechanics Research Center, Attn-AMXMR-EM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0044, DEVELOPMENT IN THE AREA OF MATERIALS PROCESSING BY SPARK SINTERING

J. GREENSPAN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4691)

The technical objectives are to develop techniques to consolidate powders of steel, aluminum, tungsten, nickel base su-

peralloy, and Ti-Ti boride mixture by spark (impulse resistance) sintering, to characterize consolidated compacts with respect to materials properties, and to extend techniques to consolidate shapes applicable to advanced or improvement of specific components as tabulated in 'Preliminary Technical Guidance, AMMRC', 5 Sept. 1972.

Metal powders (or mixtures of metal and ceramic powders) contained in a graphite die and ram assembly are subjected to a pulse of high- amperage current, which heats preferentially at particle surfaces. Ram pressure is applied simultaneously to consolidate particles. The principal advantage is attainment of very short time (less than 1 hr.) consolidation, which affects material properties and the economics of processing (compared to vacuum hot pressing which takes 8 to 24 hours).

Supporting agency address information: AMC Materials and Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0045, DEVELOPMENT IN THE AREA OF SUPERALLOY MATRIX, REFRACTORY METAL REINFORCED COMPOSITES

J. GREENSPAN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4790)

To assemble composites comprised of superalloy matrix and refractory metal fiber. To develop fiber-matrix compatibility. To determine effects of interdiffusion and/or conversion to intermediate phase. To characterize experimental composites with respect to elevated temperature strength. 12.2 alloy development for turbine application, 12.4 dev. of metal matrix composites.

Blend mixtures of spherical powders and coextrude to obtain suitable aspect ratio of the refractory phase. Heat treat for controlled interdiffusion or conversion of fiber. Identify microstructural constituents. Stress rupture test.

Supporting agency address information: AMC Materials and Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0046, DEVELOPMENT OF ALUMINUM MATRIX-GRAPHITE FIBER COMPOSITES IN THE AREA OF LAY UP AND EVALUATION OF SHAPES

J. GREENSPAN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4747)

To assemble aluminum matrix-graphite fiber composite material. To characterize lay up techniques and associated microstructures. To characterize mechanical behavior of composited shapes.

Specific shapes will be assembled using aluminum-coated graphite fiber as feeder material. To obtain plate or bar shape, assemble units of fiber in unidirectional and/or bidirectional array, and consolidate by pressure sintering. To obtain cylindrical or other convolution shape, feed fiber continuously at elevated temperature, to rotating mandrel. Consolidate by sintering.

Supporting agency address information: AMC Materials and Mechanics Rsch Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0047, MASS-SPECTROMETRIC STUDIES OF HIGH-TEMPERATURE MATERIALS

A. KANT, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4818)

The objective is to measure the high-temperature properties of silicon nitride. The properties to be measured include (1) phase relations and thermodynamic properties of solid or liquid phases in the system; and (2) kinetics and mechanisms of the vaporization process. The latter is of basic practical importance because the stability of silicon nitride is largely determined by its vaporization kinetics, at least at low pressures. The observed vaporization rates may be lower by a factor of one million than the rates predicted from equilibrium data. This accounts in part for the stability of silicon nitride at temperatures several hundred degrees above the theoretical decomposition temperature.

Molecular beams formed from the evaporated molecules are studied by mass spectrometric techniques to elicit information about the nature and properties of the molecules in the beam and of the condensed phases in equibilibrium with the vapor. Kinetics of vaporization are studied by measuring the rates of formation of various vapor species under conditions in which the vaporization process is the rate-determining step in production of the molecular beam.

Supporting agency address information: AMC Materials and Mechanics Res Ctr, AMXMR-D, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0048, MECHANICS OF BRITTLE MATERIALS

E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4698)

To complete materials characterization, evaluation of test techniques, and to provide improved design and analysis procedures for brittle materials. The particular materials are leading candidates for gas turbine applications.

Recent improvements in properties of hot pressed silicon carbide and silicon nitride suggest the importance of detailed investigation of their behavior. In particular, Norton silicon carbide has exhibited high strength values and creep resistance at elevated temperatures. The Norton hot-pressed silicon nitride designated as NC-132 has demonstrated significant tensile strength improvement. Thus the major objectives of this phase of the project will be to obtain statistical data on the stress-strain response, fracture behavior and high-frequency acoustic fatigue characteristics of these materials. Successful development of highly efficient (very high temperature) vehicular and electric power gas turbines will rest with the ability of silicon nitride and silicon carbide to survive demanding tension creep and fatigue conditions. The fatigue loadings generally occur at high frequencies and thus this aspect of behavior ought to be further explored. Finally, the influence of thermal shock, and crack growth behavior under repeated thermal excursions will be investigated.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, AMXMR-TM, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0049, MASS SPECTROMETRIC INVESTIGATION OF NITRIDATION MECHANISM OF SILICON AND ASSOCIATED SYNTHETIC PROCESSES

S. LIN, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4796)

The objectives of this proposal are aimed at elucidating the kinetics and role that impurities play in the nitridation of silicon nitride. The investigation will emphasize the roles of oxygen and hydrogen in nitridating atmosphere by mass spectrometric analysis. The examination of SiO and other gases evolved from the nitridation reaction may provide a better understanding of the existing mechanism. Other parallel investigations of silicon nitride fabrication processes from CVD and pyrolysis are also included in this proposal.

A combination of two techniques, atmospheric sampling through a jet orifice and mass spectrometric detection are to be used in these investigations. The former technique will be used to extract reactive, unstable vapor species near the heated silicon sample under nitriding atmosphere into vacuum, and the latter will mass analyze these species and determine any changes in nitriding atmosphere. By varying processing parameters of nitridation and the composition of the nitrogen atmosphere, the kinetics and mechanism of the role of impurities in the reaction could be elucidated. Also the same approach is to be used to study the fabrication processes of silicon nitride from chemical vapor deposition and pyrolysis methods.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Attn AMXMR-D, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0050, FABRICATION AND CHARACTERIZATION OF SIALON-LIKE MATERIALS

J.W. MCCAULEY, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4740)

Use of ceramics in army propulsion power generation systems requires materials of high thermal shock and oxidation resistance. Additionally, for complex geometry components such as vanes, ease of fabrication is essential. Ceramics of the sialon type silicon-metal oxynitrides should provide both with simplified processing conditions. The objective of this program is to reproducibly fabricate and sinter sialon-like materials or derivatives, and investigate their properties including thermo-mechanical and electrical. The thermal shock and oxidation resistance of sialons will also make them desirable refractories for molten metal handling in applications such as rheo- casting.

A systematic study will be carried out on the reaction products and synthesis of compounds in the system silicon-metal-oxygen-nitrogen under controlled atmosphere, pressure, and temperature. Various metals will be studied including magnesium, aluminum, and lithium. Synthesis procedures using the more readily available silicon dioxide, magnesium aluminate, and aluminum nitride will be studied as starting materials. Phase equilibria by diffusion couples and detailed characterization including crystal structure determination will be carried out if necessary.

Supporting agency address information: AMC Materials & Mechanics Res. Ctr, AMXMR-EO, Watertown, Ma. 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0051, DUPLEX CERAMIC STRUCTURES

D.R. MESSIER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4794)

The objective of this program is the development of improved ceramic composite materials for future Army propulsion applications including turbine components such as stators and bearings. The use of oxide additions to silicon before nitriding to produce reaction sintered silicon nitride composites will be explored as a means of producing material with superior high temperature mechanical and corrosion properties. Additives should also make fabrication cheaper and easier.

The kinetics of nitridation of silicon powder compacts containing oxides of gadolinium, iron, nickel, yttrium, titanium, zirconium, and magnesium will be investigated thermogravimetrically as a guide to fabrication procedures. Larger specimens of promising compositions will be made for high temperature mechanical testing and for tests of oxidation behavior. Fracture energy measurements will be made in order to relate fabrication conditions to material performance.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0052, PROCESSING OF ADVANCED CERAMIC RADOME MATERIALS

F.P. MEYER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4806)

This program will develop improved processing techniques for the fabrication of silicon nitride radomes for guided missile applications. Establishment of specific processing parameters for radome type prototypes is necessary for this second generation radome material. Superior performance as a missile radome is anticipated due to the excellent mechanical strength of this material. Prototype structures will be fabricated and subjected to thorough testing to establish optimum processing parameters.

Prototype radome structures will be fabricated by slip-casting and isostatically pressing silicon powder preforms and subsequently nitriding these objects to convert the material to silicon nitride. A thorough study of each of these forming processes will be done as well as a study of various nitriding techniques. Experimentation will be directed at obtaining maximum green density and strength in the formed radome and at obtaining reliable and reproducible final strength and dielectric properties in the fully nitrided structure.

Supporting agency address information: AMC Materials & Mechanics Research Center, Attn-AMXMR-EO, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0053, SHOCK HARDNESS OF FIBER-REINFORCED COMPOSITES

D.K. ROYLANCE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4695)

Advanced fiber-reinforced, resin-based composites are attractive candidates for utilization in interceptor substructures, and this application may require hardening against shock loading arising from nuclear bursts. This project seeks to characterize candidate composites with respect to shock propagation and shock-induced damage, and to supply necessary materials data for substructure design purposes.

The characterization procedure developed during previous phases of this project for graphite/epoxy composites will be applied to a wider range of materials to include 4- and 5.6-mil boron in addition to graphite fibers, and to high-temperature and thermoplastic matrices. Laminates will be shock loaded by means of exploding foil-spall threshold will be determined and multiple carbon gages will be used to monitor wave propagation characteristics. Static mechanical and physical properties will be measured.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0054, FABRICATION OF ENVIRONMENT-RESISTANT COMPOSITES

D.K. ROYLANCE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4802)

Fabrication-structure-property relations will be obtained for a wide variety of engineering composites and processing methods. Processing parameters and quality assurance tests will be determined so as to eliminate or minimize environmental degradation during the service life-times of Army end items utilizing these materials. Long-term design-allowable data will be generated germane to the service environment to be experienced by the selected end item. Components for aviation systems will be emphasized, due to the markedly improved efficiency (as compared to metals) of lightweight composites in these systems. Pacing problem areas (from FY75 guidance, materials technology plan for aircraft)- 1.5, 1.6, 2.1, 2.4, 7.1, 9.2, 12.5. This project will also be in direct support of pacing problems for many Army systems other than aircraft. Major program thrust- 4.g (aircraft survivability).

Thermosetting and thermoplastic matrices, reinforced with chopped or continuous glass, graphite, or kevlar fibers, will be used in fabricating test specimens by means of a wide variety of processing methods--wet and prepreg filament winding, automatic and manual prepreg layup, injection and compression molding, and sheet calendering. Resulting physical and mechanical properties important in actual service use will be determined before, and at various times after, exposure to accelerated and actual outdoor weathering. Materials degradation mechanisms will be identified and the information used to develop processing methods for deterioration prevention.

Supporting agency address information: AMC Materials & Mechanics Research Center, Attn-AMXMR-RD, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0055, DYNAMIC MECHANICAL PROPERTIES OF COMPOSITE MATERIALS

M.E. ROYLANCE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4694)

Obtain dynamic mechanical loss and damping characteristics for fiber-reinforced, resin-based composites as well as chopped fiber reinforced thermoplastics as a means of investigating the influence of the fiber/matrix interface on the response of the composite structure to oscillatory and impulse loading.

A torsion pendulum apparatus will be used to investigate the effects of resin cure cycle, voids, and fiber surface treatment on the mechanical loss response of graphite, glass and PRD-49 reinforced resin matrix composites, and chopped fiber reinforced thermoplastic composites as a function of temperature. These data will be correlated with failure mechanisms, fracture toughness, and fatigue characteristics of the composite materials.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, AMXMR-RF, Watertown, Ma

SUPPORTED BY U.S. Dept. of Defense - Army

3.0056, PREVENTION AND PREDICTION OF ENVIRONMENTAL DETERIORATION OF ORGANIC MATERIALS
R.E. SACHER, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0D4815)

The goals of this program are to determine and correlate the extent and severity of critical chemical, mechanical and physical property changes in exposed polymer and composite materials, in order to provide effective methods of prediction and prevention of environmental deterioration of these materials in Army materiel.

Novel polyphosphazenes, polyurethanes and graphite and kevlar fiber composite systems will be simultaneously characterized and subjected to environmental effects at selected field sites and in laboratory apparatus. Post-exposure deteriorative changes in the materials will be determined by a number of instrumental techniques and mechanical tests developed to follow degradation phenomena. Modes and mechanisms of deterioration will be correlated with critical mechanical and physical property changes in the material. Glass fiber reinforced composite systems will be modified to resist environmental deterioration and exposed under the most severe weathering conditions. Samples will be returned and evaluated as to the amount and cause of degradation. An analytical expression will be developed for glass/fiber composites to predict the deterioration of a material for specific applications. Also NDT techniques will be further developed to follow deterioration.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, AMXMR-RF, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0057, FATIGUE AND FRACTURE OF COMPOSITE MATERIALS
J. SLEPETZ, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0C4687)

To develop rational bases for predicting failure in fiber- reinforced composites subjected to static and fatigue loads, to determine fail-safe crack arrest capability of stiffened composite panels, and to establish design guidelines for laminated composites under static and fatigue load conditions. Use of composites in major aircraft systems such as HLH, UTTAS, and AAH requires adequate knowledge and predictability of structural performance of these materials. This work unit supports the AMC major thrust area of aircraft survivability.

Fracture toughness experiments on S-glass/epoxy and graphite/epoxy compact tension specimens are being carried out. Fracture tests and stress concentration experiments have been made on unidirectional and laminated composite specimens to simulate conditions in structural panels with geometric or battle damage discontinuities. Crack arrest studies are being carried out on stiffened composite panels.

Supporting agency address information: AMC Materials & Mechanics Res Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0058, GROWTH OF SEMICONDUCTOR COMPOUNDS BY THE SCHMID-VIECHNICKI CRYSTAL GROWTH TECHNIQUE
D. VIECHNICKI, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0E4785)

Large, inexpensive semiconductor crystals are not currently available for many Army applications such as infrared detectors, energy convertors, and laser windows. The Schmid-Viechnicki crystal growth technique which has a demonstrated capability for growth of large single crystals will be used to meet this need.

Germanium and silicon will be grown by the Schmid-Viechnicki crystal growth technique. Graphite and fused silica crucibles 2.5 cm to 5.0 cm will be used. Processing parameters for reproducible growth will be determined. Crystals will be characterized by standard techniques including Hall effect measurements. Feasiblity of using liquid phase encapsulation will be determined. This feature and the use of fused silica containers will tell if it will be feasible to grow GaAs, GaP, and CdS from the melt under high pressures in a later program.

Supporting agency address information: AMC Materials & Mechanics Research Ctr, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

3.0059, INTEGRATED OPTICS
D. CHEN, Honeywell Incorporated, *Minneapolis, Minnesota* 55413 (DN323025; N00014-73-C-0359)

Integrated optical circuits offer unique opportunities for optical signal processing and transmission. Lanthanum-modified lead zirconate titanate (PLZT) is a promising material for use in light modulators, deflectors, and waveguides and has the unique property of ferroelectric memory. The goals of the program are to prepare PLZT films suitable for integrated optics studies and obtain characterization of PLZT materials relevant to integrated applications.

This research will include: film fabrication using liquid phase epitaxial growth, chemical vapor transport, and diffusion techniques; characterization of the physical properties of PLZT; analysis of mode propagation in PLZT waveguides; and fabrication of an integrated optics modulator using PLZT waveguides.

Supporting agency address information: Office of Naval Research 411, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0060, TWO-DIMENSIONAL MULTIPLE SCATTERING OF THERMAL RADIATION
A.L. CROSBIE, Univ. of Missouri, School of Engineering, *Columbia, Missouri* 65201 (ENG74-22107)

A theoretical and experimental study will be undertaken to investigate multiple scattering, two-dimensional radiative transfer. Through the use of exact radiative transfer theory, the integral equation for the source function will be formulated along with expressions for intensity and radiative flux. Both isotropic and anisotropic scattering will be considered. The method of separation of variables will be employed, and the resulting integral equations will be solved for a wide range of physical situations. An experimental effort will be made to verify the theory as well as to examine various approximations, i.e., one-dimensional model, isotropic scattering. Physical situations to which the results can be applied include laser propagation through the scattering media, such as the atmosphere and ocean water, and passive and active remote sensing and determination of particle size distributions in the fields of health, power, metallurgy, and chemistry.

SUPPORTED BY U.S. Natl. Science Foundation

3.0061, CARBON-NICKEL INTERFACE STUDIES RELATED TO THE STRUCTURAL PROPERTIES OF GRAPHITE FIBER-NICKEL COMPOSITES
L.L. LEVENSON, Univ. of Missouri, School of Arts, *Rolla, Missouri* 65401 (GH-41353)

A study of the graphite-nickel interface will be undertaken because of the role played by this interface in the structural and mechanical properties of graphite-nickel composites. At present little direct information is available on this subject, although these composites hold promise for high-temperature, high-strength applications.

The analytical tools to be used in this study are Auger electron spectroscopy (AES), low-energy electron diffraction (LEED) and ion milling. With these tools the surface structure and chemistry of nickel films on clean graphite surfaces will be determined. The quantities of nickel will range from fractions of an atomic layer to several thousand atomic layers. By use of desorption studies combined with in depth composition profiling done by AES in combination with ion milling, the bond strengths of the Ni-carbon interface, and diffusion constants of nickel in graphite and carbon in nickel will be measured. By the use of LEED, the interface structure in nickel graphite systems as a function of thermal treatments and impurity levels will be examined.

This information will aid technologists in choosing the fabrication processes which will give the most promise of success. In-house testing of graphite-nickel composites will be carried out later in this program. Information gained in the first stages of this study will find direct application in the later stages.

SUPPORTED BY U.S. Natl. Science Foundation

3.0062, NAVY VEHICLE DESIGN AND CONSTRUCTION - PROPERTIES OF HEAT RESISTANT PLASTICS AND RUBBERS

J.K. GILLHAM, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (DN023005; N00014-67-A-0151-0024)

This work provides structure-property information on new heat resistant polymers (derived from Navy research) used for selection of optimum chemical systems and development of processes for their conversion to useful material. A further objective is the identification and understanding of degradative processes which limit the performance polymeric materials so that suitable protective measures can be developed.

An advanced form of Princeton's 'torsional braid apparatus' developed by the principal investigator is used to obtain the thermomechanical spectra of a series of new polymers with systematic differences in structure. Experiments cover the complete temperature profile of potential use (-180C through 650C) in both inert and oxidative environments. The nature of degradative processes in these polymers will also be investigated employing a mass chromatograph as well as a rapid-scan IR spectrometer, both of these instruments being capable of direct examination of degradation products, resulting from thermal, oxidative or other deterioration mechanisms.

Supporting agency address information: Office of Naval Research 472, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0063, FABRICATION SCIENCE IN FINE GRAINED TECHNICAL CERAMICS - PRESINTERING STAGES

J.S. REED, Alfred University, Graduate School, *Alfred, New York* 14802 (DMR75-05445)

This research will study fundamental aspects of processing well- characterized ceramic powders, such as yttria stabilized zirconia, silicon carbide, and alumina. Starting powders will be characterized by: (a) chemical and atomic absorption spectroscopy and X-ray diffraction, and (b) transmission and scanning electron microscopy to determine particle size distribution, state of aggregation and shape. Characterization will be continued after each step in processing: milling, beneficiation, slip development and pressure casting, pressing, and sintering. The aim will be to assess final microstructural development such as porosity and grain structure and selected mechanical properties in terms of various factors affecting processing. These include absorbed surface ions, particle size and shape agglomeration and aggregation, the state of deflocculation, and sintering kinetics as measured by dilatometry.

SUPPORTED BY U.S. Natl. Science Foundation

3.0064, ELASTIC AND PLASTIC DEFORMATION OF SOLIDS

A.L. RUOFF, Cornell University, School of Engineering, *Ithaca, New York* 14850 (AT(11-1)3153)

Research to produce ultra-fine-grained carbides (300A maximum intercept) by hot isostatic compaction. Hope this year to produce fully dense 2000A aggregates and possibly 800A aggregates.

Intend to extend yield stress determinations in potassium to higher pressures to observe 100% increases to check possible deviation from sigma 0 equals sigma 00 (1 plus E0' P/E). Expect to make length versus pressure studies (with fractional error delta (delta l/l) equals 2x10 to the 8th power) in CsBr and NaCl and if time permits to potassium or sodium. Intend to continue ultrasonic pressure work to determine second derivative of bulk modulus of cerium and other crystals and of glass.

Results: Yield stress of potassium observed to increase 60% by pressure. First and second pressure derivative of bulk modulus computed for Na and CsBr, in good agreement with values measured ultrasonically in our laboratory. Murnagham and Grover Getting Kennedy equation were shown to give upper and lower bounds to theoretical expressions for bulk modulus B vs P, B sv V/Vo and V/Vo vs P. Hot isostatic compaction (which primarily involves high temperature deformation) used to produce fully dense TaC, 1 micron grain size without grain growth. Order of magnitude reduction in creep rate of LiF by small Mg ions additions explained.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0065, MATERIALS AND MECHANICS OF RATE EFFECTS IN BRITTLE FRACTURE

S.J. BURNS, Univ. of Rochester, School of Engineering, *Rochester, New York* 14627 (AT(11-1)-2422)

The critical stress intensity factor for propagating cracks, as a function of temperature and microstructural variables for as-received, annealed/recrystallized steel is measured. The brittle region of fracture, below the brittle to ductile transition temperature is emphasized. The effects of microstructural variables on the critical stress intensity factor in the brittle region of fracture is investigated. The closed form mechanics solution for a propagating crack is known for a wedged-double-cantilever beam. The electrical measurement of the crack length as a function of time is used to calculate the critical stress intensity factor during crack propagation. The crack velocity in this loading scheme is not constant and strain rate effects on the critical stress intensity factor can be measured.

Results: In the brittle region of fracture, it has been found that increasing the crack velocity decreases the critical stress intensity factor, KId. The lowest value of KId occurs for the fastest obtainable crack, velocity .25 square root of E/rho when fractured at liquid nitrogen temperature.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0066, DIFFUSIONAL CREEP OF MULTICOMPONENT SYSTEMS

J.C. LI, Univ. of Rochester, School of Engineering, *Rochester, New York* 14627 (AT(11-1)-2296)

This project is now getting to the stage of actual measurements of penetration creep of both molecular solid solutions and metallic alloys. The behavior of experimental data has been predicted theoretically. It involves both a transition of creep behavior in temperature and in stress. The composition variations of activation enthalpy and the stress exponent are predicted also. The equipment building is near completion and some data on succinonitrile have been obtained already. Everything seems in order. It is expected that at the conclusion of this project, the understanding of creep behavior of multicomponent systems will be considerably advanced.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

3.0067, INTERGRANULAR FRACTURE AND THE DISCLINATION MODEL OF GRAIN BOUNDARIES 10608 MC

J.C. LI, Univ. of Rochester, School of Engineering, *Rochester, New York* 14627 (DA0D9063; DA-ARO(D)-31-124-73-G77)

To study the phenomena of intergranular fracture, hydrogen embrittlement, and void formation at grain boundaries during creep. Relevance- this research is relevant to a host of technological applications involving, for example, embrittlement of high-strength material, creep of structural components, and fragmentation of munitions.

Using concepts that involve disclination structures of high angle boundaries, the research will include but not be restricted to studies of: (1) the mechanical stability of a high-angle grain boundary with a disclination structure; (2) the interaction between mobile solute atoms and disclination boundaries, and the periodic distribution of solute; (3) the mechanical stability of a grain boundary with impurities, and the effects of such impurities on strength; and (4) the sliding of a disclination boundary, and associated nucleation, coalescence, and growth of cavities. On the

basis of the foregoing, attempts will be made to determine the kinds of boundary that are most and least susceptible to intergranular fracture, weakening by impurities, sliding, and void formation.

Supporting agency address information: OCRD Research Office, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

3.0068, MATERIALS SUPPORT TECHNOLOGY - OPTIMIZATION OF PROCESSING VARIABLES FOR SINTERED COVALENTLY-BONDED CERAMICS

R.J. CHARLES, General Electric Company, *Schenectady, New York* 12305 (DN475436; N00014-74-C-0331)

The Navy is concerned with improved power plant concepts for aircraft, marine and ground uses. Ceramics are promising materials for use in such systems because of their potential for reducing costs by allowing (1) more efficient fuel use, (2) higher outputs to be achieved from simpler machines, (3) use of lower grade fuels. They must possess high strength and resistance to thermal shock, and be economically fabricated into complex shapes. Silicon nitride and silicon carbide are leading candidates for such use. This research is concerned with advancing new capability and understanding in pressureless sintering of such covalently-bonded ceramics for applications such as turbine components (e.g., shroud rings).

A determination of the chemical elements that reduce grain boundary energies of selected ceramics (silicon nitride, boron nitride, aluminum nitride, uranium nitride, spinel, graphite) will be done. Thermochemical data will be used to identify reaction mechanisms necessary for production of uncontaminated, free surface conditions for such materials. Efforts will be made to develop dense structures in complex shapes. Powder preparation, particle size and composition will be carefully controlled for this. Thermal, structural, and electrical behavior of materials developed above will be characterized and evaluated for prototype applications.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0069, TRANSPORT PROPERTIES OF METAL OXIDES IN THE PRESENCE OF SULFUR

H.S. SPACIL, General Electric Company, *Schenectady, New York* 12305 (DF040570; F44620-75-C-0043)

Corrosion problems in aircraft jet engines are primarily related to the high temperatures at which engines operate and the nature of the fuels and associated impurities of combustion products. Both conditions are likely to get worse. Air bases in marine environments further aggrevate the hot corrosion problem. Alkali metal salts in the air combine with sulfur in the fuel to form sodium sulfate films which originate and sustain hot corrosion. This research seeks to determine the mechanism by which sulfur is transported across normally protective oxide scales, and how it influences oxidation. Electrical conductivity measurements will be made on single crystal and polycrystalline oxides in gaseous atmospheres at controlled oxygen and sulfur pressures. Complemented by thermogravimetric data, a predictive mechanistic model for corrosion will be obtained.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0070, DIFFUSION AND CREEP IN NIOBIUM CARBIDE AS A FUNCTION OF TEMPERATURE AND CARBON CONTENT

R.F. DAVIS, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27600 (DA0E5578; DAHC04-75-G-0113)

To study the diffusion and deformation of niobium carbide at high temperature, and their relationship to each other. Relevance - the proposed research is relevant to the resistance of carbon materials to creep at high temperatures. Non-oxide ceramics (silicon nitride and silicon carbide) are being considered for use in high temperature gas turbines on the ARPA contract to Westinghouse and Ford under AMMRC monitorship. High-temperature creep is one of the major materials problems at the moment. These turbines are presently being considered for use by the Army in high-speed generators, and perhaps for vehicles, pending the success of the Ford effort. The carbide materials are currently being used in the form of whiskers as reinforcement for metal- matrix composites. These composites also are being considered for use in high-temperature turbines.

The program will include, but will not be limited to, the following: (1) measurement of self-diffusion coefficients of 14C and 95Nb in single crystals of NbCs having various carbon-to-metal ratios and at various times, temperatures, and atmospheres; (2) measurement of creep at constant stress for the same temperatures, atmospheres, and carbon-to-metal ratios; (3) characterization of the chemical compositions and microstructures of the specimens.

Supporting agency address information: AMC Army Research Office, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

3.0071, SELF-DIFFUSION AND CREEP STUDIES IN ALPHA AND BETA SILICON CARBIDE

R.F. DAVIS, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27600 (DMR74-22481)

The following will be undertaken in this study: 1. To obtain and carefully characterize high purity gamma-SiC single crystals and gamma and Beta-SiC powders. The characterization studies will be conducted using the most appropriate techniques available including mass spectroscopy and wet chemical analysis. The oxygen and nitrogen levels will be especially noted. 2. To fabricate and characterize high density polycrystalline specimens by sintering and/or hot pressing techniques for use in diffusion and creep studies. 3. To determine the coefficients and activation energies of self-diffusion of Si and C in Beta and Beta-SiC at several temperatures and times at temperature. 4. To initiate constant stress creep experiments under the same conditions of atmosphere and temperature range as the diffusion studies.

SUPPORTED BY U.S. Natl. Science Foundation

3.0072, ULTRASONIC INSPECTION OF CERAMICS FOR GAS TURBINES

T. DERACS, T R W Incorporated, *Cleveland, Ohio* 44117 (DN590024; N00019-75-C-0238)

To investigate high frequency ultrasonic techniques for nondestructive inspection of silicon nitride and silicon carbide ceramics containing small flaws (10-100 microns).

Pulse echo techniques will be studied initially using ultrahigh frequencies in the 25-75 MHz range. Attenuation coefficient of the materials will be measured and acoustical velocities determined. The optimum frequency will be established for trade-offs between defect size, attenuation, and sensitivity.

Supporting agency address information: Naval Air Systems Command, Washington, D. C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0073, MICROSTRUCTURE AND HIGH-TEMPERATURE PROPERTIES

J.A. ROBERSON, U.S. Air Force, Aerospace Research Labs., *Dayton, Ohio* (DF212840)

AF function - advanced aerospace vehicles. Deficiency - strength and lifetime of components at elevated temperatures. Research - improved microstructures. How research contributes - changes in materials processing to produce more favorable microstructures could affect the strength and reliability of many structural materials.

Various metal working techniques (i.e. forging, swaging, powder metallurgy) will be examined with the goal of determining methods for producing optimum mechanical properties, structural uniformity, and minimum costs.

Supporting agency address information: Aerospace Research Laboratory LL, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

3.0074, STUDY OF LEAD TITANATE ZIRCONATE DOUBLE ADDITIVE SYSTEMS
D. BERLINCOURT, Channel Products Incorporated, *Newbury, Ohio* 44065 (DN590534; N00024-75-PR-60141)

Analyze the results of compositional studies of double additive systems of ceramic (PZT) materials made by several Japanese companies.

Make an analysis of the published results of the double additive compositional PZT materials and test those compositions with favorable characteristics for radiating transducers.

Supporting agency address information: Naval Sea Systems Command, Washington, D. C. 20362

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0075, FABRICATION AND SURFACE CHARACTERIZATION OF COMPOSITE REFRACTORY COMPOUNDS
L.W. SWANSON, Oregon Grad. Ctr. Stu. & Res., *Beaverton, Oregon* 97005 (NSG 3054; 506-24-21)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

3.0076, EFFECT OF RETAINED AUSTENITE ON HYDROGEN EMBRITTLEMENT IN HIGH STRENGTH MARTENSITIC STEEL (ABBREV)
W.E. WOOD, Oregon Grad. Ctr. Stu. & Res., *Beaverton, Oregon* 97005 (DMR75-10326)

The threshold stress intensity conditions for crack initiation and crack growth are dependent upon the hydrogen concentration for a tempered martensitic high strength steel, and may be significantly improved by metallurgical modifications that affect the rate of hydrogen diffusion. A unique distribution of retained austenite throughout the martensitic structure will permanently trap and harmlessly neutralize large amounts of otherwise mobile hydrogen. A model incorporating retained austenite will be investigated, wherein the threshold stress intensity level will be increased and the crack growth rates decreased, while maintaining high yield strengths and improved fracture toughness. The effects of yield strength, stress intensity level, hydrogen concentration, carbide precipitation and other microstructural variables will be determined.

SUPPORTED BY U.S. Natl. Science Foundation

3.0077, SPECTROSCOPIC STUDIES OF (A) METAL BOROHYDRIDES AND (B) SIMPLE CARBON-NITROGEN COMPOUNDS
J.W. NIBLER, Oregon State University, School of Liberal Arts, *Corvallis, Oregon* 97331 (5580AC36)

SUPPORTED BY Amer. Chemical Society - Washington, D.C.

3.0078, DEFECT ASSOCIATION IN TERNARY OXIDES
D.M. SMYTH, Lehigh University, School of Arts, *Bethlehem, Pennsylvania* 18015 (DMR74-21095)

Research in defect chemistry of BaTiO3and SrTiO3 will be pursued to find evidence for defect association, the enthalpy of the association of doubly-charged defects, and the thermodynamic parameters for rotational motion of vacancy pairs.

SUPPORTED BY U.S. Natl. Science Foundation

3.0079, A STUDY OF THE ONE-DIMENSIONAL METAL POLYSULFUR NITRIDE
M.M. LABES, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (DMR74-24202)

Polysulfur nitride behaves like a one-dimensional metal down to 4.2 degrees K. The variability of the conductivity with crystal growth conditions has been examined with the best crystals showing room temperature conductivities of approximately 1000 omega minus 1 cm minus 1 along the chain axis, increasing by a factor of 11-13 down to 20 degrees K and decreasing only slightly at lower temperatures. The apparent anisotropy of the conductivity is a factor of 50 at room temperature and a factor of 500 at 20 degrees K. Thin films of (SN)x can be prepared in which the conductivity has a low thermal activation energy presumably involving interparticle resistances. As the crystal samples have improved in physical perfection, the low temperature conductivity has tended to become significantly larger, and impurity scattering is observed at significantly lower temperatures. The possibility of observing superconductivity in (SN)x alone or incorporated into matrices will be explored in the proposed program, as well as the potential of (SN)x as a metal. Some of the structures to be explored are precisely of the type hypothesized to display the exciton mechanism of superconductivity which may lead to substantially enhanced transition temperatures.

SUPPORTED BY U.S. Natl. Science Foundation

3.0080, POLYOLS FOR HIGH- AND LOW-DENSITY POLYURETHANE FOAMS
A.N. WRIGLEY, U.S. Dept. of Agriculture, Eastern Regional Research Ctr., *Philadelphia, Pennsylvania* 19118 (0042027; 1402-15760-006)

OBJECTIVE: Prepare from animal fats polyols suitable for the production of superior high- and low-density polyurethane foams.

APPROACH: Polyols will be made by reaction of epoxidized tallow with trimethylol-propane followed by propylene oxide; by similar reactions with sorbitol, sucrose, lactose or lactitol; and from selected hydroxyalkyl, hydroxyamino or diamino derivatives of tallow-based acids. The resulting polyols will be polymerized with polyisocyanates to give high-density and low-density urethane foams, which will be tested for fire-retardance, strength, dimensional stability, and other properties needed in furniture, decorations, or insulation.

PROGRESS:

SUPPORTED BY U.S. Dept. of Agriculture - A.R.S. - E.R.R

3.0081, MATERIAL SUPPORT TECHNOLOGY - METALLIC GRAPHITE INTERCALATED COMPOUNDS
J.E. FISCHER, Univ. of Pennsylvania, School of Engineering, *Philadelphia, Pennsylvania* 19104 (DN575151; N00014-75-C-0751)

Development of intercalated graphite metallic fibers for use in high-strength composite wires offers applications in naval systems which feature room temperature conductivities equal to or better than copper and are lighter, stronger, and cheaper than a comparable copper wire. The objective of this program is to determine the electronic structure of these compounds in order to correlate the electrical behavior with their atomic structure and composition, with the view to being able to design better conductors.

Metallic graphite intercalation compounds will be studied in the dilute limit and in the concentrated limit in order to follow the change in electronic structure between these limits. Experiments will focus on fermiology and optical properties. Studies of magnetic susceptibility and magnetoresistance will be used to ascertain the effect of the intercalate on the Fermi surface and on transport parameters. The optical studies will rely heavily upon thermoreflectance spectroscopy.

Supporting agency address information: Office of Naval Research, Arlington, Va 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0082, MATERIALS RESEARCH PROGRAM
A.J. HEEGER, Univ. of Pennsylvania, Graduate School, *Philadelphia, Pennsylvania* 19101 (DMR72-03025 A05)

Interdisciplinary materials research will be carried out in the thrust areas of Chemical and Extractive Metallurgy, Molecular Crystals, Surfaces and Interfaces, and Materials Failure Criteria. In addition, individual projects in Electronic and Magnet Materials will be undertaken, as will an energy related seeding program on the electrical properties of intercalated layered graphite. Substantial support on the electrical properties of intercalated layered graphite. Substantial support for operation and improvement of the extensive central facilities will also be provided.

This is a continuation of DMR-7203025. Other than a further strengthening of the thrust concept, particularly in the Materials Failure area, and introduction of the intercalated graphite program, no major program changes are contemplated.

SUPPORTED BY U.S. Natl. Science Foundation

3.0083, ELECTRICAL TRANSPORT PROPERTIES OF GRAPHITE INTERCALATED COMPOUNDS
T.E. THOMPSON, Univ. of Pennsylvania, School of Electrical Engin., *Philadelphia*, *Pennsylvania* 19104 (DMR75-04954)

This is an experimental study of the electrical conduction processes of metallic graphite intercalated compounds--in particular, the acid intercalates. The primary goal is to correlate the electrical behavior of those materials with their structure and composition, with the view of eventually being able to design a practical conductor with conductivity comparable to, or better than, that of copper. Resistivity, Hall effect, and magnetoresistance measurements will be made on graphite fibers and single crystals at temperatures ranging from 4.2 K to 370 K with magnetic fields to 30 kG or higher. Initial investigations will be made on graphite intercalated with nitric acid and with boron trifluoride.

SUPPORTED BY U.S. Natl. Science Foundation

3.0084, LOW TEMPERATURE SPECIFIC HEATS OF GRAPHITE INTERCALATION COMPOUNDS
T.B. MASSALSKI, Carnegie Mellon University, Inst. of Technology, *Pittsburgh*, *Pennsylvania* 15213 (DMR74-18523)

Low temperature specific heat measurements on graphite intercalation compounds will be undertaken. Graphite intercalation compounds are of interest for several reasons. Some of the metal-rich compounds become superconductors despite the fact that neither graphite nor the solute species involved show superconductivity. Since graphite is abundant there is some possibility that they may be important for energy storage. The structure of such compounds consists of layers of hexagonally arranged carbon atoms intermixed with layers containing the intercalate atoms. This particular feature is responsible for the fact that the resulting materials have many properties of a sandwich-like structure in which behavior is often 'two-dimensional' in nature. Since superconductivity and the two-dimensional nature of these compounds are related to the electronic structure, probing the electronic structure by measurements of low temperature specific heat will be undertaken.

Two preliminary experiments of C8K and C24K compounds indicate an unusual anomaly in the heat capacity of the C8K compound and surprisingly large values of the electronic specific heat in both compounds.

This research will establish low-temperature specific heat data for a number of graphite intercalation compounds involving two metals, potassium and cesium and a non-metal bromine. It is expected that the data will provide useful information relevant to the understanding of the electronic structure of intercalation compounds, to the behavior of superconductors, and to the properties of two-dimensional-like compounds. This research is, therefore, relevant to the field of materials in the area of energy, conductivity, and superconductivity and possibly energy storage.

SUPPORTED BY U.S. Natl. Science Foundation

3.0085, BRITTLE MATERIAL DESIGN FOR HIGH TEMPERATURE GAS TURBINES
R.J. BRATTON, Westinghouse Electric Corp., *Pittsburgh*, *Pennsylvania* 15235

Description: The objective of this program is to develop ceramic blades and vanes for use in gas turbines at temperatures up to 2500 degrees F. Tasks include development of finite element stress analysis computer codes for creep and contact stresses; design of an advanced test gas turbine; corrosion-erosion evaluation tests on silicon nitride (Si(3)N(4)) and silicon carbide (SiC); measuring physical and chemical properties of Si(3)N(4) and SiC; fabrication and non-destructive testing of stator vane assemblies.

SUPPORTED BY U.S. Dept. of Defense - D.A.R.P.A.

3.0086, MATERIALS SUPPORT TECHNOLOGY - HIGH TEMPERATURE STRUCTURAL CERAMICS BASED ON SILICON COMPOUNDS
F.F. LANGE, Westinghouse Electric Corp., *Pittsburgh*, *Pennsylvania* 15235 (DN475435; N00014-74-C-0284)

Ceramics are candidates for high temperature structural applications (e.g., gas turbines) in corrosive, thermally and mechanically cycled environments. This investigation concentrates on high temperature structural ceramics based on silicon compounds. The chief objectives are to improve the high temperature mechanical properties of hot-pressed silicon nitride and to determine usefulness of low expansion metal oxide-silicon nitride solid solution compositions for high temperature structural applications.

The formation mechanism of alpha silicon nitride (alpha-Si3N4) by nitridation of pure (calcium free) and doped silicon powder will be investigated and related to additives, morphology and particle size of resultant alpha-Si3N4. High purity alpha-S3N4 will be hot-pressed. Microstructural changes will be studied to control development of the high fracture toughness, high-strength elongated grain morphology. Flexural strength for improved Si3N4 materials will be measured (room temp. to 1500 C) and correlated with impurities and microstructures, and also as a function of stressing rate to determine subcritical crack growth susceptibility. Creep behavior and stress-rupture data will be determined. Metal oxide-Si3N4-compositions with different amounts of oxides (e g., Al203, Fe203, Y203, Li20-Al203) will be fabricated by hot- pressing and sintering. Lowest thermal expansion systems and phases present will be identified. Strength behavior will be investigated to 1400 C. Fracture energy and elastic modulus will be measured. Subcritical crack growth at high temperatures is to be determined as are oxidation resistance and thermal conductivity.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0087, STRUCTURAL MATERIALS FOR CRYOGENIC APPLICATIONS
G.G. LESSMANN, Westinghouse Electric Corp., *Pittsburgh*, *Pennsylvania* 15235

Description: The purpose of this study is to identify and evaluate the mechanical behavior of selected structural materials from room temperature to 4.2 degrees K. Emphasis of this effort is on (1) utilizing fracture mechanics technology at cryogenic temperatures to evaluate the K(IC) (TiC) fracture toughness and the fatigue crack growth rate, (2) considering selected materials processing and fabrication (MFP) techniques to elucidate significant effects of MPF on cryogenic behavior of these alloys, and (3) evaluating the general and specific cryogenic structural materials considerations required to establish failure-safe design materials selection and utilization criteria. Four materials are being considered: OFHC Copper, ALSI 310S Stainless Steel, Inconel X750 Superalloy, and Kromarc 58 Stainless Steel. Materials processing consideration include three commercial melting practices with IN X750, powder metal consolidation of IN X750 by hot isostatic pressing (HIP), and cold work.

SUPPORTED BY U.S. Dept. of Defense - D.A.R.P.A.

3.0088, MATERIALS SUPPORT TECHNOLOGY - MECHANISMS OF IMPACT DAMAGE AND FRACTURE FOR CERAMICS
H.P. KIRCHNER, Ceramic Finishing Company, *State College*, *Pennsylvania* 16801 (DN475309; N00014-74-C-0241)

Components for naval systems fabricated from ceramic materials include gas bearings for gyros, sonar transducers, radomes and IR domes. In addition, ceramics are candidates for use (e.g., in turbomachinery) in severe environment applications. Understanding of fracture mechanisms is needed to identify various contributions to mechanical failure (applied loads, residual stress from processing, flaw effects, fatigue, etc.) in order to attempt (1) improvement of mechanical behavior and reliability and (2) protection of ceramic components against in-service damage. Information about many important aspects of fracture of ceramics is fragmentary, especially those concerned with impact damage.

Quantitative analysis of fracture surfaces and formulation of fracture mechanisms will be emphasized for polycrystalline ceramics. Theoretical calculations will take stress concentration, nonlinear elastic behavior at stresses near the theoretical strength, and interfacial forces acting across cracks into account at (or near) crack tips. Fractography experiments will include identification of factors affecting intensity of fracture features and correlations with mechanical behavior. Factors affecting impact resistance of ceramics (especially silicon nitride) will be investigated, including frequency of internal fractures (compared with flexural tests), failure stresses of impact fractures (from mirror sizes), energy absorbed during impact, and effect of stress waves on impact fracture.

Supporting agency address information: Office of Naval Research 471, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

3.0089, ENVIRONMENTAL EFFECTS UPON THE TIME-DEPENDENT FRACTURE OF SILICON NITRIDE AND SILICON CARBIDE

R.E. TRESSLER, Penn. State University, School of Earth Sciences, *University Park, Pennsylvania* 16802 (DA0D9285; DAHC04-74-G-0142)

To determine the influence of various ambient environments on the time-dependent failure of silicon nitride and silicon carbide ceramics. This investigation is especially relevant to the use of ceramic components in the gas turbine, owing to the fact that silicon nitride and silicon carbide are the primary materials being considered in the $15-million ARPA effort to develop the ceramic turbine. Ceramic turbines, having a higher operating temperature, offer increased efficiency at lower fuel consumption for vehicles, such as jeeps and trucks, and for electrical generating systems. A knowledge of the stress corrosion of ceramics is necessary for the improvement of their reliability in structural applications.

The program will include: (1) measurement of the velocity of crack propagation as a function of stress intensity factor, atmosphere, and temperature; (2) determination of mechanisms of stress-corrosion cracking in these covalenty bonded ceramics; and (3) calculation of enthalpies of activation for observed stress-corrosion reactions.

Supporting agency address information: OCRD Army Research Office, Box CM, Duke Station, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

3.0090, PREPARATION AND CHARACTERIZATION OF TRANSITION METAL FLUORONITRIDES AND OXYFLUORIDES

A. WOLD, Brown University, Graduate School, *Providence, Rhode Island* 02912 (OIP73-02290 A01)

The proposed research is a continuation of the collaborative effort between the solid state research laboratory at Brown University and the solid state research laboratory at the University of Bordeaux. Future proposed research will carry on the work started on iron and vanadium fluoronitrides, complete it and utilize techniques developed at Brown University for the reaction of transition metal fluorides with transition metals in sealed gold tubes containing liquid ammonia. These experiments may be carried out as a function of temperature and pressure.

There exists high-pressure equipment at both the Brown and Bordeaux Laboratories although the more sophisticated equipment is at Bordeaux. The electrolysis of molten titanate-fluoride melts should lead to interesting new compositions and the attempted preparation of members of the systems such as SnO 2-xFx, TiO 2-x Fx and ZrO2-xFx will be started by both direct combination as well as the electrolysis of fused salt technique.

SUPPORTED BY U.S. Natl. Science Foundation

3.0091, ULTRA-HIGH PURITY TRANSITION METALS AND ALLOYS AND MULTIPHASE COMPOSITES THROUGH SOLIDIFICATION

B.F. OLIVER, Univ. of Tennessee, School of Engineering, *Knoxville, Tennessee* 37916 (GH-40471)

This is a continuation of research on the development of novel purification processes for reproducibly making ultra-high purity cobalt and nickel in bulk form. These two metals are the base matrix materials for composite superalloys. The purification processes under study involve ion exchange prepurification of commercial metal chloride and oxidation zone refining subsequent to reduction of the purified chloride to metal. The processes under study involve a unique combination of aqueous chemistry and high temperature physical chemistry. The processes under study have the following characteristics and advantages: (1) the number of mass separations have been reduced to a minimum of three; (2) the processes reproducibly lead to an ultra-high purity metal regardless of the starting material; and (3) the final oxidation zone refining phase which involves controlled solidification is crucibleless and operational in oxidizing, reducing, and inert atmospheres, as well as vacuums at 10 to the minus 7th power torr. Two phase coupled growth theory has been experimentally extended for the Pb-Sn-Cd system to three phase coupled growth processes. Modeling of impurity effects for a binary system with the impurity level sufficient to make the system a true ternary system have been developed. The modeling and experimental studies will be extended to include the Sn-Cd-Bi system, to delineate necessary conditions for n-phase coupled growth from the liquid.

This is a renewal of grant GK-26584.

SUPPORTED BY U.S. Natl. Science Foundation

3.0092, MASS SPECTROMETRIC AND MATRIX ISOLATION SPECTROSCOPIC INVESTIGATIONS OF HIGH TEMPERATURE SYSTEMS

K.A. GINGERICH, Texas A & M University System, School of Science, *College Station, Texas* 77843 (MPS75-10075)

The proposed research will include study of molecular metal and intermetallic compounds, gaseous metal carbides, pnictides, oxides, sulfides, hydrides, and phosphorus and oxygen containing molecules by way of mass spectrometry and matrix isolation. Selected condensed alloys will also be studied. The emphasis will be on the determination of thermodynamic properties and molecular parameters. The high temperature mass spectromtric method will yield thermodynamic properties of the molecules and condensed materials. Matrix isolation infrared and Raman spectroscopic studies will be performed to obtain molecular parameters. The results will contribute to the further development of empirical theories of bonding and improvement of their predictive power. They are expected to aid the finding of new materials with improved properties and the understanding of the energetics of inorganic as well as biological reactions. Special emphasis will be given to systems and problems of significance in catalysis and in energy conversion. This work is a continuation of that currently supported by GP-28937.

SUPPORTED BY U.S. Natl. Science Foundation

3.0093, INORGANIC PROTECTIVE COATINGS FOR TURBINE BLADES

H. VANAMERONGEN, Central Org. Adv. Appl. Res., *Delft, the Netherlands*

Objective: Best possible suppression of 'hot corrosion' of the blades--made from the superalloy IN-738--of stationary gas turbines, without impairment of their mechanical strength.

Motivation of research: The research constitutes the completion of earlier work (COST Project of EEC) fitting into research on wider applications of similar inorganic layers. It complies with NO-TNO's EEC commitments, and is in line with government policies. The research is coordinated by the Project Group for Turbomachines TNO.

Programme: a) Preparation of a number of titanium/silicon coatings (on the superalloy IN-738). The samples are to be tested in cooperation with the Metal Research Institute TNO, Apeldoorn, The Netherlands. b) Study of the mechanisms (accompanying the hot corrosion and the repression thereof) by means of chemical and mineralogical analysis of the substrate and of Ti/Si coatings of suitable types.

SUPPORTED BY the Netherlands Government - the Hague

3.0094, HIGH-PRESSURE SYNTHESIS OF B-W- AND NACL-TYPE COMPOUNDS
H.T. HALL, Brigham Young University, School of Biological Sciences, *Provo, Utah* 84601 (DMR72-03051 A03)

Techniques involving high pressures (to 70 kbars) and high temperatures (to 1800 degrees C) will be used to investigate the possible synthesis of B-W-type A3B compounds for the following systems: A equals Nb with B equals Cd, Tl, Pb; A equals V with B equals Cd, In, Tl, Pb; A equals Ta with B equals Cd, In, Tl, Ge, Pb; A equals Ti with B equals As, Bi, Se, Te; A equals Zr, Hf with B equals As, Sb, Bi, Se, Te; A equals Cr, Mo, W with B equals Ag, Au, Se, Te; A equals Mn, Re with B equals In, Tl, Ge, Sn, Pb, As, Sb, Bi, Se, Te. Possible ternary compounds of the same type which are isoelectronic with known high temperature superconductors (such as Nb3Ge) will also be investigated. Examples of the many possibilities are Nb3(In, Sb), Nb3(Cd,Te), (Zr, Mo)3Sn, (Ti,Cr)3Ge. Also the NaCl-type compounds NbC, VC and TaC will be prepared at high pressures and temperatures in an effort to make them more nearly stoichiometric. The new compounds prepared will each be examined for superconductivity.

Continued research initiated under GH-33793 (DMR-7203051).

SUPPORTED BY U.S. Natl. Science Foundation

3.0095, ELECTROCATALYSTS FOR ACID ELECTROLYTE FUEL CELLS
J.A. PEDRICK, U.S. Army, Mobility Eqp. Res. & Dev. Ctr., *Fort Belvoir, Virginia* 22060 (DA0L3702)

There is a need in our present fuel cell technology for an electrode that will oxidize carbon monoxide to carbon dioxide thus avoiding the poisoning affect of carbon monoxide on the cell reaction. the FY74 objective of this research is to confirm that sulfur-covered platinum electrodes increase the rate of conversion of carbon monoxide to carbon dioxide in a sulfuric acid electrolyte. These same electrodes will then be evaluated using phosphoric acid as the electrolyte at higher temperatures. The activities of carbon monoxide, carbon dioxide and hydrogen will be studied. Future objectives will include the study of sulfur covered raney-platinum electrodes and sulfur covered raney- platinum on tungsten-carbide electrodes. It will be determined whether carbon monoxide can be oxidized in the presence of hydrogen.

The cell in this research will be a three chambered cell with a working, counter, and reference electrode. An atmosphere of hydrogen sulfide will be forced through the platinum working electrode to provide the sulfur chemisorbate. The electrolyte, sulfuric acid, will be maintained below 100 degrees C whereas the phosphoric acid will be run between 130 degrees and 150 degrees C.

Supporting agency address information: TROSCOM Mobility Equip R & D Center, Ft. Belvoir, Va 22060

SUPPORTED BY U.S. Dept. of Defense - Army

ENGINEERING

Includes Engineering (general); Communications; Electronics and Electrical Engineering; Fluid Mechanics and Heat Transfer; Instrumentation and Photography; Lasers and Masers; Mechanical Engineering; Quality Assurance and Reliability; and Structural Mechanics. For Related Information See Also Physics.

4.0001, HEAT TRANSFER THROUGH CRYOGENIC MICROSPHERE INSULATION
C.L. TIEN, Univ. of California, School of Engineering, *Berkeley, California* 94720 (GK-30557 01)

Microsphere insulation differs from traditional packed-sphere insulation in that hollow metal-coated spheres are used. Compared to solid spheres, hollow spheres substantially increase the resistance to heat flow and reduce heat capacity and weight. A thin metal film on the surface is effective in providing radiation shielding. This relatively new concept is an extension of previously used multilayer insulations and super-insulations, and it has several potential advantages over these more traditional techniques. Results of this research could lead to new improved insulations for cryogenic systems.

Analysis of microsphere insulation will be performed accounting for both heat conduction and radiation effects. Experimental measurements will be obtained for comparison with the analytical results in order to improve the analytical models and provide an improved understanding of the mechanisms involved. This new information should apply to the engineering design of better insulation materials. Parameters to be investigated include sphere size, surface optical properties, packing porosity, temperature and compressive loading.

SUPPORTED BY U.S. Natl. Science Foundation

4.0002, RESEARCH ON BOUNDARY LAYERS
J. LAUFER, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (ENG72-04099 A02)

This action extends the duration of GK-35800X another year with additional funding.

Four areas will be examined in detail during the course of this experimental project. These are: 1) Viscous sublayer-mapping of flow fields just before and after the 'burst' detection, i.e. the generation of an inner intermittency function. 2) Inner and outer flow interaction--using the inner and outer intermittency functions and of various statistical operations to search for a relationship between 'bursts' and 'bumps'. 3) Turbulent spot-detailed study of the 'bump' and the associated large scale motion. 4) Turbulent spot formation--to examine the possible similarity between turbulence generation mechanism within a fully developed turbulent boundary-layer and spot generation in a laminar boundary-layer undergoing transition.

SUPPORTED BY U.S. Natl. Science Foundation

4.0003, CONTINUATION OF A STUDY OF THE JET MEMBRANE SEPARATION PROCESS
E.P. MUNTZ, Univ. of Southern California, School of Engineering, *Los Angeles, California* 90007 (ENG74-00690)

This is a joint effort between U.S.C. and Drexel on the separation process. It involves both basic mechanism and systems studies.

Basic Mechanisms: A. Theoretically and experimentally establish the effect of background pressure on the separation mechanism. B. Theoretically and experimentally establish the dependence of molecular scattering parameters on system parameters. C. Theoretically and experimentally study the separation mechanism at low jet pressure ratios.

Extraction and System Studies: A. Study various extraction configurations, so that extraction area is maximized relative to jet orifice area. B. Consider briefly candidate jet fluids and system configurations associated with thermal cryopumping of the jet.

SUPPORTED BY U.S. Natl. Science Foundation

4.0004, METAL OXIDE LASER
D.J. COLLINS, U.S. Navy, Postgraduate School, *Monterey, California* 93941 (DN327006)

HN3-C alpha 2 as a system has been investigated both experimental and theoretically.

Pulse gain measurements have been made for it is believed the first time on the HN3-C alpha 2. Gains of the order of 50 percent meter were obtained. This is somewhat greater than the theoretical predictions of the Russians.

Supporting agency address information: Naval Air Systems Command, Washington, D.C. 20361

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0005, DEVELOPMENT OF PHOTOGRAMMETRIC TESTING AND EVALUATION PROCEDURES
J. MORI, State Div. of Highways, *Sacramento, California* 95814 (020983(HRB NO.))

An area has been established where precise control points will provide basic data for testing photogrammetric components and systems. This area will also be used for testing and evaluating surveying equipment and will possibly be used as a training area for surveyors. Reports issued: Development of photogrammetric testing and evaluation procedures. Phase 2, Testing and evalua-

tion of photogrammetric systems, interim report, G. Erio, R. Burns, June 1974.

Document provided to S.S.I.E. by the H.R.I.S.

SUPPORTED BY U.S. Dept. of Transportation - F.H.A.

4.0006, AUTOMATIC MANIPULATOR POSITIONING SYSTEM

C. MORRIN, U.S. Navy, Ocean Technology Department, *San Diego, California* 92132 (DN488663)

To develop a control system for rate-controlled manipulators which can be programmed to position an arm rapidly and accurately in a variety of predetermined locations.

The manipulator arm position will be determined by voltage-dividing potentiometers placed on the arm joints. Sensor data will be digitally compared to reference values stored in an IC memory to determine direction of arm movement. In multiple position sequences, the first position cannot be reached as accurately as the second; hence, a variable dead band will be utilized to prevent overshoot. The electronics will be pressure tolerant.

Supporting agency address information: Naval Material Command, Director of Laboratory Programs (01), Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0007, CANTILEVER ACCELEROMETER INVESTIGATION

B. BLOCK, Diax Corporation, *Sunnyvale, California* (DF100630; F33615-75-C-1113)

To experimentally verify the potential of a unique multi-cantilever beam accelerometer for inertial grade performance. The goals for this accelerometer are adequate accuracy in a strapdown system application, no thermal control, reliability and low cost. These goals include an accuracy on the order of 10 over 6G, bias stability and repeatability of 10 over minus 4G, a reliability of 10,000 hrs and a cost in the 200 to 300 dollar range.

There are three potential designs possible with this concept. These include (1) a double beam single axial design, (2) a double beam bi-axial design, and (3) a double beam tri-axial design. All three designs will be investigated and one or more will be fabricated and tested for feasibility.

Supporting agency address information: AF Avionics Laboratory RWN, Wright-Patterson AFB, Ohio 45433

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0008, APPLICATION OF STATISTICAL MECHANICS TO CONTROL THEORY AND INFORMATION THEORY

E.R. COHEN, Rockwell International Corp., *Thousand Oaks, California* 91320 (DF034880; F44620-72-C-0072)

The use of adaptive control in the Air Force is expected to increase with applications to larger and more complex systems. While the control of large systems usually necessitates an adaptive approach because of the incompleteness of the observations possible, there exists a severe need for drastically reducing the amount of information required. The objective of this effort is to continue the investigation of this problem within the framework of statistical mechanics where such reductions of information have already been achieved in other contexts. Specific objectives of this phase of the effort include (1) specializing the Fokker-Planck equation for cases in which systems are very large and the controls and observations are very gross, (2) investigating the controllability, observability, and entropy change for classical and quantum systems in microscopic and macroscopic state space, (3) defining a stochastic process in macroscopic state space that is equivalent to each generalized Fokker-Planck equation, and (4) selecting an illustrative example to demonstrate the applicability of previous results.

Supporting agency address information: AF Office of Scientific Research NPP, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0009, REMOTE DETECTION OF STACK POLLUTANTS BY MEANS OF CONCENTRATION MODULATION

F.S. BARNES, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (ENG74-15276)

The purpose of this research is to develop a system for making remote measurements of photo-chemical pollutants effluent from stacks. There is currently a variety of techniques for remote-sensing of these pollutants. These include IR spectroscopy, Raman spectroscopy, optical hetrodyne techniques, etc. However, all these techniques suffer from high optical noise due to background radiation and stack emissions. It is proposed to use an ultraviolet beam to modulate the concentration of these pollutants by means of photo-chemical reactions. This provides modulated infra-red emission signals which can be selectively detected against unmodulated optical noises by means of simple signal processing techniques. The improvement of signal to noise ratios due to this method is calculated to be a hundred times to about 10 to the 4th power times, depending on the pollutant species under measurement and the degree of cloudiness in the sky. The proposed program will proceed in three parts: (1) Completion of the analysis and design of the pollution detection system; (2) Construction and laboratory testing of an instrument; (3) Testing on remote sites.

SUPPORTED BY U.S. Natl. Science Foundation

4.0010, SWIRLING HEATED TURBULENT FLOWS AS RELATED TO COMBUSTION CHAMBERS

M.S. UBEROI, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (DOD-4965-48)

Description: Turbulence and mixing determines level of combustion efficiency, noise generation and heat transfer in swirling flows. The measurements will provide design information for combustion chambers used in turbojets, rockets and various internal combustion engines. Our objective is to experimentally study the change in turbulent mixing due to swirl and heating of jets. Using ensemble averages, the mixing in turbulent flows will be determined across the well-defined although convoluted surface which separates the turbulent from non-turbulent flow. Results of mean temperature velocity and fluctuations will be compared with the usual time-average measurements. Some analytical predictions of the flows will be made which are of interest in combustion chambers. A newly developed shooting hot-wire probe will be used to instantaneously measure temperature and velocity profiles. Fluctuations and mixing within the turbulent zone will be determined from an ensemble of measured profiles. This technique determines the fluctuations within the turbulence zone rather than the average between turbulent and non-turbulent zones. With the use of an effective turbulent viscosity, the recirculating flow inside a free flame and in an annular swirling flame inside a divergent combustion chamber will be analytically investigated. We have finished some preliminary work on the turbulent mixing using the new technique. See publication no. 2 below. Some of the results are compared with conventional measurements also made here. See publication no. 1 below. Some theoretical work has been successfully completed and the following paper submitted to the Canadian Journal of Chemical Engineering: 'Three-Dimensional Turbulent Wall Jets,' by J.P. Narain.

Bibliographic references: Accepted for publication in The Physics of Fluids; (1) 'Experiments on Turbulent Structure and Heat Transfer in a Two-Dimensional Jet,' J. Bashir and M.S. Uberoi, scheduled for publication at latest April, 1975; (2) 'Turbulent Mixing in a Two- Dimensional Jet,' M.S. Uberoi and P.I. Singh.

Addenda: Estimated calendar year funding reported as 1974 $7,000, 1975 $23,000.

SUPPORTED BY U.S. Dept. of Defense - Navy

4.0011, STRUCTURE AND COMPUTER DESIGN OF LARGE SCALE AUTOMATIC CONTROL SYSTEMS

A.S. MORSE, Yale University, School of Engineering, *New Haven, Connecticut* 06520 (DF033280; AF-AFOSR-2211-72)

The trend toward high-performance, sophisticated Air Force systems should be reflected by more rapid developments in the area of control theory, not only to meet the tighter system specifi-

cations but also to ensure the reliability of these costly systems. This proposal is for continuing support of a research program focusing on this need. The central goal of the program is to develop concrete analysis and design methods for dealing with engineering problems encountered in the design of complex control and information systems. In attaining this goal, studies will be made of a number of important design problems associated with the identification and control of linear multivariable systems. Included will be the continuation of a fundamental study of the relationship between feedback, system invariants, and the structural properties of multi-input, multi-output dynamical systems. A study will be made of decentralized feedback systems with the objective of developing techniques for designing such systems and making them invulnerable to component failure. For the purpose of realizing reliable identification and modelling procedures for dynamical systems an investigation will be made of the relationship between system invariants and problems associated with the identification process. In an effort to understand the structural characteristics of delay-differential systems and the effects of feedback on these characteristics, a study will be made of such systems using ring-algebraic models.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0012, INTERNAL EMP INSTRUMENT DEVELOPMENT - FERROELECTRIC SENSOR

P.S. BRODY, U.S. Army, Harry Diamond Laboratories, *Washington, District of Columbia* 20310 (DA0D5737)

The objective is the development of a small passive ferroelectric sensor for measuring the electric field associated with the space charge cloud of emitted electrons within an enclosing metal surface. Specific goals are to include maximizing response to peak electric fields of selected polarizations and frequency content, minimizing remanent effects of shock radiation. It is expected that the investigation will interface with IEMP experiments on underground tests. The ultimate objective is to furnish usable field test equipment on experimental agencies.

Plans are to 1) Determine the relation between pulse field magnitude and remanent polarization at temperatures above room temperature. 2) Make similar measurements for material which have their Curie temperatures shifted toward room temperature. 3) Investigate the use of single crystals. 4) Investigate ferroelectrics other than barium titanate and solid solutions of barium titanate and admixtures. 5) Develop a useful phenomenological theory for pulse polarization. 6) Make direct radiation effects tests utilizing underground tests and flash X- ray machines.

Supporting agency address information: AMC Harry Diamond Labs, Washington, D.C. 20438

SUPPORTED BY U.S. Dept. of Defense - Army

4.0013, BUILDING A STEREO PICTURE RELAY SYSTEM FOR MANIPULATORS AND REMOTE CONTROL VEHICLES IN NUCLEAR TECHNOLOGY INSTALLATIONS

KLEINWAECHTER, Kleinwaechter Res. & Dev. Lab., *7850 Loerrah, Federal Republic of Germany* (RS0113)

SUPPORTED BY Federal Republic of Germany Govt.

4.0014, PREPARATION AND CHARACTERIZATION OF SUPERCONDUCTING QUANTUM INTERFERENCE DEVICES

W.G. MOULTON, Florida State University, School of Arts, *Tallahassee, Florida* 32306 (DF030080; AF-AFOSR-1940-70)

New approaches to Air Force guidance, navigation, remote sensing, and detection of electromagnetic radiation depend upon new solid state superconducting devices. Superconducting quantum interference devices (SQUIDS) include cryogenic, ultra-sensitive magnetometers in the D.C. to high audio frequency range, low-temperature, supersensitive detectors and mixers of electromagnetic radiation in the radio, microwave and far infrared regions of the spectrum. This research seeks to modify the critical current density of a variety of superconducting materials in order to design wide-bridge (100 micrometers) reliable weak-link Josephson junction devices. Superconducting crystals and thin films of pure elements, transition metals, rare earths compounds and layered- structure dichalcogenides are being prepared by vapor deposition, electron beam melting, by the implantation of magnetic ions and intercalalation of alkali metals. The critical temperature and the critical current density are measured as functions of composition, crystal structure, impurity concentration, ambient temperature and applied magnetic field. The structural integrity, current, voltage, frequency, and magnetic field characteristics of these junctions as low- temperature supersensitive electromagnetic detectors are being investigated.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0015, STABILITY OF FLOW THROUGH ELASTIC TUBES

R.T. SHIELD, Univ. of Illinois, School of Engineering, *Urbana, Illinois* 61801

A study of the stability of a distended circular tube of highly elastic material with fluid flowing through the tube has been initiated. The influence of the fluid velocity and the fluid pressure on 'ballooning' of the tube will be investigated.

SUPPORTED BY University of Illinois

4.0016, ANALYSIS OF STATIC EXCITERS BY STATE VARIABLE TECHNIQUES

M.L. DOANE, Purdue University, School of Electrical Engin., *Lafayette, Indiana* 47907

Non-rotational, solid state exciters are analyzed digitally using a 10th order state variable model. The model includes all nonlinearities, and may or may not include the exciter stabilizer. The objective is to use modern control theory to minimize the error energy dispatched.

SUPPORTED BY Purdue University - Lafayette, Ind.

4.0017, PATTERN ANALYSIS AND ADVANCED AUTOMATION RESEARCH

K.S. FU, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (ENG74-17586)

The Advanced Automation Research Laboratory (AARL), recently formed at Purdue will continue pursuing the research pattern information processing, adaptive and learning systems, and robotic systems. Although a number of projects are presently supported individually, this program will emphasize cooperative research rather than individual effort. This unified and coherent program will focus on solving problems of a larger scale, in comparison with existing efforts in these areas. The research will start with an integrated program, within the broad area of advanced automation, concentrating on the following specific projects: (1) Theory of Pattern Analysis and Processing, (2) Picture Processing and Recognition, (3) Speech Processing and Recognition, (4) Learning and Self-Organizing Control Systems, and (5) Autonomous Robotic Systems. The proposed research is a long-range program toward advanced automation. Our initial program will concentrate on information processing and control aspects. At a later stage of the program, research on sensor development and integrated large-scale systems will be included.

SUPPORTED BY U.S. Natl. Science Foundation

4.0018, AUTONOMOUS ROBOTIC CONTROL SYSTEM

J.Y. LUH, Purdue University, School of Electrical Engin., *Lafayette, Indiana* 47907 (GK-41615)

The proposed research project, involves studying robots which are expected to perform more complicated tasks than those that are performed by the existing robots. To accomplish the goal, on-line learning control (or self-organizing control) concepts will be applied to the robotic system. This approach provides a closed-loop of the overall system which yields a means of recognizing the errors that cause mission failures, and enabling the system itself to

correct the errors for the succeeding missions. The auxiliary problem of pattern recognition will be approached by syntactic methods. The interactions of the sensing system, pattern analysis system, and the robotic controls will be evaluated.

SUPPORTED BY U.S. Natl. Science Foundation

4.0019, SPECIALIZED RESEARCH EQUIPMENT
R. VISKANTA, Purdue University, School of Engineering, *Lafayette, Indiana* 47907 (ENG75-17097)

Funds are provided for purchasing a circular variable filter wheel module which would convert the existing Barnes Spectral-master Model 12- 550 infrared research radiometer into a rapid scanning high resolution field instrument. The radiometer is to be used in spectral remote sensing of temperature distribution and trace impurity concentration in glass as well as in simultaneous temperature and concentration distribution recovery in a mixture of radiating gases as well as combustion products and flames.

This research project is being supported under the National Science Foundation Grant ENG-7102399 AO1. The need for the scientific research equipment is immediate. In addition to the stated research project, there are six other projects for which there is use for the instrument within the University.

SUPPORTED BY U.S. Natl. Science Foundation

4.0020, DIGITAL DATA SYSTEM FOR TURBULENCE STUDIES
R. BETCHOV, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (ENG74-24048)

The purpose of this action is to provide partial support toward the purchase of a real time data acquisition system. The heart of this system is a mini-computer with the associated disc memory, analog- digital converter, and a seven track magnetic tape subsystem.

SUPPORTED BY U.S. Natl. Science Foundation

4.0021, PURCHASE OF A LASER DOPPLER ANEMOMETER
T.J. MUELLER, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (ENG75-18403)

During the past few years the laser Doppler anemometer has been developed to the point where it is now a powerful research tool. Many velocity measurements which were heretofore very difficult or even rendered impossible by the presence of pilot tubes or hot-wire anemometers and by the difficulties inherent in the design of these instruments are now possible to make with the LDA. The purchase of such an instrument is difficult to justify on the average research grant or departmental budget. Thus, it is the purpose of this proposal to request $18,000 from the National Science Foundation for the purchase of a Disa Laser Doppler Anemometer to enhance the basic research capabilities of the Department of Aerospace and Mechanical Engineering at the University of Notre Dame. The requested equipment is directly related to the present research programs in the Department. The solicited equipment would also serve as an invaluable training ground for the graduate students who would be involved in the research programs.

SUPPORTED BY U.S. Natl. Science Foundation

4.0022, RESEARCH IN FEEDBACK CONTROL SYSTEMS WITH LARGE PARAMETER UNCERTAINTY
I. HOROWITZ, Weizmann Institute of Science, *Rehovot, Israel* (DF289260; AF-AFOSR-2549-73)

AF function - control theory. Deficiency - existing control theory and techniques are applicable only to deterministic systems. Research - this research addresses three classes of problems to which present control theory is only applicable for simplified cases. These classes of problems are those where the parameters of the system and the system itself are subject to some uncertainty, where the system contains some unavoidable nonlinearity, and systems with multiple loops. How research contributes - this research will aim to generate methods applicable to the design of control systems for more realistic applications.

The effect of large parameters uncertainty in feedback control systems will be studied by synthesizing: a) multiple input-output systems with plant ignorance, b) a single loop time-varying system with plant ignorance, c) linear feedback systems with incidental nonlinearities.

Supporting agency address information: European Ofc of Aerospace Rsch & Dvlpmt NRP, FPO New York 09510

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0023, KINETICS OF ADVANCED GASDYNAMIC AND CHEMICAL LASERS
J.D. ANDERSON, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (DF037380; AF-AFOSR-2575-74)

This is a basic research effort which could eventually produce a significant increase in gasdynamic laser performance. In particular, it treats a concept for obtaining more than 300 kw/(1bm/sec) from an advanced CO2-N2 gasdynamic laser. The research examines the kinetics of the energy exchange in a downstream mixing gasdynamic laser, including the mixing effects. This work will result in (a) the first fundamental analysis, taking into account all the important kinetic and gasdynamic processes, of the downstream mixing in an advanced gasdynamic laser, (b) the first detailed study and assessment of the real potential of downstream mixing gasdynamic lasers operating at high temperature (4000 degrees K), and therefore (c) a possible significant jump in the performance of gasdynamic lasers.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0024, STUDY OF METAL-INSULATOR-SEMICONDUCTOR SOLAR CELL
H.C. LIN, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (ENG74-19310)

Metal-insulator-semiconductor devices presently being fabricated in connection with a National Science Foundation sponsored study entitled 'Study of Electronic Trimming Using Metal-Nitride-Oxide-Semiconductor Devices' will be examined for their potential as solar cell devices. The MIS solar cell should yield voltages and efficiencies comparable to that of present p-n junction cells. A titanium-insulator-p-type semiconductor structure and a gold-insulator-n-type semiconductor will be studied. The insulator will be silicon dioxide and silicon nitride.

SUPPORTED BY U.S. Natl. Science Foundation

4.0025, A TRANSLATING SLENDER SHIP IN VARIABLE-DEPTH SHALLOW WATER
A. PLOTKIN, Univ. of Maryland, School of Engineering, *College Park, Maryland* 20740 (ENG74-20573)

The potential flow field generated by a slender ship translating in variable-depth shallow water will be examined using the method of asymptotic expansions. The major new effect to be investigated will be the unsteady flow field induced by the depth variations. Forces and moments will be determined for simple hull and bottom geometries.

SUPPORTED BY U.S. Natl. Science Foundation

4.0026, GENERALIZED CONTROL THEORY
Y. HO, Harvard University, School of Arts, *Cambridge, Massachusetts* 02138 (GK-31511A1)

This project is concerned with problems of generalized control theory like dynamic optimization problems involving multiple payoff, multiple players and multiple information patterns, such problems were considered previously in game theory but can be solved more effectively by the generalized control theory discussed by this project.

This is a continuation of research conducted under NSF Grant GK- 31511.

SUPPORTED BY U.S. Natl. Science Foundation

4.0027, THE CONTROL OF LARGE SCALE AND DISTRIBUTED PARAMETER SYSTEMS
L.A. GOULD, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (GK-41647)

This project is composed of two parts of research: a) Study of Large Scale Systems which involves decentralized control of traffic networks, structural problems in large scale systems, new approaches to optimal time and impulse control problems. b) Investigation of distributed-parameter systems which covers systems with local memory, optimal control of systems related to thermal phenomena, feedback stabilization of unstable systems, identification and estimation and air pollution estimation algorithms.

This program involves continuation of collaboration between the Decision and Control Science Group of the Electronics Systems Laboratory at M.I.T. and the Institute de Recherche d'Informatique et d'Automatique (IRIA) Paris, France.

SUPPORTED BY U.S. Natl. Science Foundation

4.0028, RESEARCH INITIATION - STOCHASTIC CONTROL OF DATA COMMUNICATION NETWORKS
N.R. SANDELL, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (ENG75-10517)

The purpose of the research is to bridge a gap between the theory of large scale systems (as it is developing in the control theoretic literature) and the practical engineering design of such systems. Specifically, it is proposed to examine the routing problem in packet switched data communication networks within the framework of the non- classical stochastic control problem. It is expected that examining a physical situation in which a decentralized pattern of information unavoidably arises will give insight into the theory of decentralized stochastic control. Similarly, it is expected that the quantitative modeling and optimization of packet routing algorithms will be a contribution to the design of packet switching data networks.

SUPPORTED BY U.S. Natl. Science Foundation

4.0029, DEVELOPMENT OF HIGH-PERFORMANCE HYDRAULIC GAIN BLOCKS AND SYSTEMS
D.N. WORMLEY, Mass. Inst. of Technology, School of Engineering, *Cambridge, Massachusetts* 02139 (DA0D5762; DAAG39-72-C-0200)

1. A. Development of high-performance, multistage hydraulic fluid gain blocks for both pressure gain and power gain applications. B. Utilization of multistage gain blocks in signal processing and control applications.

2. A. To apply and extend design guides developed in HDL-TR-1608 (Flueric 33. Design and staging of laminar proportional amplifiers) to the design of hydraulic fluidic proportional amplifier gain blocks. B. To apply applicable control system theory to develop a demonstrator control system using fluidic-hydraulic gain blocks.

Supporting agency address information: AMC Harry Diamond Labs Fluidics Sys Res Br, Washington, D.C. 20438

SUPPORTED BY U.S. Dept. of Defense - Army

4.0030, EVALUATION OF ADVANCED FIBER BEARING CONCEPTS
E.M. LENOE, U.S. Army, Materials & Mechanics Res. Ct., *Watertown, Massachusetts* 02172 (DA0F4724)

The purpose of this project is to construct and evaluate the potential of a fiber bearing concept for non-lubricated applications.

Several types of graphite, boron, and silicon carbide fibers will be fabricated into special sleeve journal bearings and test data on durability and wear response of these different bearings will be obtained.

Supporting agency address information: AMC Materials & Mechanics Res Center, Attn-AMXMR-D, Watertown, Ma 02172

SUPPORTED BY U.S. Dept. of Defense - Army

4.0031, EXPERIMENTAL STUDIES OF GAS BLAST CIRCUIT BREAKERS
R.L. PHILLIPS, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (AER74-20514)

This research is concerned with theoretical and experimental studies of the effects of nozzle geometry, reservoir conditions, and current behavior on the performance of gas blast, alternating current power circuit breakers. When a short circuit or fault occurs in a power system, high values of fault currents are established and in order to remove the fault, circuit breaker action is required. The successful operation of a gas blast circuit breaker depends on the forced replacement of the ionized gas in the gap between the opening contacts with fresh neutral gas directed by a nozzle system from a pressurized reservoir. The higher the value of current being interrupted, the greater is the volume of ionized gas which must be replaced. If the ionized gas is not displaced, the circuit breaker fails to interrupt the circuit. A cascade nozzle apparatus which will yield electrical, spectral, and photographic measurements of transient, blown arc behavior has been developed. The constructed apparatus will be used to study the phenomena that contribute to successful interruption of high-power electric faults in A.C. gas blast circuit breakers. To study the effects of gas pressure and nozzle geometry on the arc electrical and thermal characteristics radial and axial temperatures will be measured and mapped. Measurements of arc resistance to thermal re-ignition at various imposed transient current waveforms will be performed.

This is a continuation of work started under grant GI-326248X and GI-36248X1.

SUPPORTED BY U.S. Natl. Science Foundation

4.0032, STUDIES IN HYDRODYNAMIC STABILITY
D.D. JOSEPH, Univ. of Minnesota, School of Engineering, *Minneapolis, Minnesota* 55414 (GK-40800)

A perturbation theory for linearized non-parallel flow which leads to a uniformly valid zeroth order. The development of a nonlinear and non-parallel flow perturbation theory. Computation of the time periodic solution which bifurcates from Poiseuille flow down annular pipes by a Poincare-Lindstedt method. Further studies of the possible bifurcation of quasi-periodic solutions with N frequencies into quasi-periodic solutions with N plus 1 frequencies. A bifurcation theory for multi- gamma solutions of the Euler equations arising in the variational theory. Studies of turbulence in the flow driven by a pressure gradient between cylinders which slide and rotate relative to one another. The effect of energy producing nonlinearities on the stability of flow.

SUPPORTED BY U.S. Natl. Science Foundation

4.0033, RELIABILITY EVALUATION OF MNOS ARRAYS
C.A. HELTZ, Sperry Rand Corporation, *St. Paul, Minnesota* (DF735770; F30602-74-C-0237)

The objective of this effort will be to evaluate the reliability of MNOS (metal-nitride-oxide-silicon) non-volatile read/write memory-array, integrated circuits.

The approach will be to perform high-stress and life tests on representative production devices from several major manufacturers presently using this technology. Device characterization and detailed failure analysis will be used as a basis for identifying failure modes and mechanisms and developing suitable qualification and screening tests. This effort will be directed specifically to MNOS memory arrays consisting of non-volatile read/write functions and stable read/only functions fabricated on the same chip, and will concentrate on the analysis of mechanisms which degrade the performance of such functions. Also to be considered in this effort will be an evaluation of the reliability to be expected of such devices when operating in a transient nuclear radiation environment. This procurement is not amenable for award to a small business. In order to qualify, the source must have testing facilities for large scale memory circuits as well as extensive device failure analysis capabilities. End item will be a report.

Supporting agency address information: Rome Air Development Center RBR, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0034, INTEGRO-DIFFERENTIAL NUMERICAL SOLUTION OF THE NAVIER-STOKES EQUATIONS

J.F. THOMPSON, Mississippi St. University, School of Engineering, *Mississippi State, Mississippi* 39762 (ENG74-21349)

The use of numerically generated body-fitted curvilinear coordinate systems for numerical solution of the time-dependent, incompressible Navier-Stokes equations in the integro-differential formulation will be investigated. Initial effort will be directed at two-dimensional solutions, with three-dimensional solutions to follow. Flow fields containing single and multiple bodies of arbitrary shape, stationary and moving, will be considered. The solution will provide velocity and vorticity fields, body surface pressure distributions, and force coefficients. The solution will be verified by comparison with experimental results for surface pressure and force coefficients, periodic vortex shedding frequency, and flow patterns. Comparisons of results and efficiency will be made with other numerical procedures.

SUPPORTED BY U.S. Natl. Science Foundation

4.0035, CONTROL, GUIDANCE AND INFORMATION FUNDAMENTALS OF AEROSPACE

J. ZABORSZKY, Washington University, School of Engineering, *St. Louis, Missouri* 63130 (DF028420; F44620-69-C-0116)

The control and guidance of aerospace vehicles is of obvious interest to the Air Force. The military importance of this research is in the potential of major improvements in such control and guidance of missiles and aircraft. Optimal control techniques have already contributed significantly to spectacularly successful control of spacecraft. This research includes, moreover, the development of fundamental results in the fields of information extraction and filtering, which are fundamental to trajectory determinations and in all guidance situations involving missiles and aircraft. Further research will be conducted in the deterministic and stochastic fundamentals of optimal control in logistics, in computational and optimization methods for optimal operations and designs as in optimization of logistics or of fighter plane design, and in the development of reduced order and practical models for optimal control which may make it possible to extend optimal control principles to more complex systems. This research is to be performed on the theoretical aspects of these problems which are in the following areas of competence of this group--estimation, filtering and stochastic control, control of systems in the presence of uncertainty, state observers and state estimators, optimal control and optimization techniques, differential games, information theory, learning control systems, and controllability of nonlinear systems.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0036, ANALYTICAL STUDIES OF TURBULENT FLOW FIELDS

G.L. MELLOR, Rutgers the State University, School of Engineering, *New Brunswick, New Jersey* 08903 (DF028700; AF-AFOSR-2756-75)

The AF will require improved aerospace systems in the future which will give operational capabilities, weapon delivery and reconnaissance superior to those of any potential enemy. In the design of propulsion systems, ground power equipment, air intakes, and aerodynamic shapes which require drag, heat transfer, and pressure fluctuation information, it is necessary to control and predict the behavior of fluid flow. In most cases, adequate predictive methods are available for shear flows with favorable and zero pressure gradients and for laminar boundary layers. Predictive methods are inadequate for shear flows with adverse pressure gradients which, in many cases, involve turbulent boundary layers. One of the more sophisticated mathematical models of the physical characteristics of turbulent boundary layers is the mean turbulent field (MTF) concept being developed by the PIS. They have recently established the frame work for even more sophisticated, higher order models while concurrently completing a more simplified study of incompressible turbulence. This latter study is now being applied in the higher order framework to study the complications of compressible flow.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0037, SEPARATED FLOW STUDIES IN SUPERSONIC TURBULENT BOUNDARY LAYERS

S.M. BOGDONOFF, Princeton University, School of Engin. & Appl. Sci., *Princeton, New Jersey* 08540 (DF041440; F44620-75-C-0080)

The supersonic, separating boundary layer is a commonplace occurrence on AF high performance aircraft, air breathing propulsion inlets, and missiles. Increased understanding of this phenomena is vital to the progress of high speed aerodynamics for design improvements of these vehicles. The proposed work is to provide experimental measurements of separated-reattaching flow in a corner and of incipient separation in order to extend previous measurements and modeling to broader ranges of Reynolds number. The separated-reattaching flow studies will go to Reynolds numbers of 10 sup 6 based on boundary layer thickness. Reattachment studies will be made on boundary layers on a thicker scale than heretofore in order to provide more significant spatial resolution of the details of the critical phenomena. The investigation previously completed of the onset of separation at Mach number 3 over a wide variation of Reynolds number showed a negligible Reynolds number effect. There is some doubt about this, because of the previous use of tripped layers. The present work is to extend this work to lower Reynolds numbers, i.e. 10 sup 6 to 10 sup 9 based on length. This would offer a correct framework of extrapolation for extensive low Reynolds number results available.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0038, MULTIFUEL, OPTIMAL STRATIFICATION IN SPARK IGNITED ENGINES

F.V. BRACCO, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (AER74-21220 A01)

Direct injection stratification of the charge in the engine promises to be a relatively minor variation of the current spark ignition reciprocating engine capable of delivering higher mileage and lower emissions. The achievement of satisfactory stratification over the entire load-rpm range and with various fuels requires a more fundamental understanding of the stratified charge combustion processes. Sophisticated and detailed mathematical models have been developed and studies of the theoretical results have indicated possible ways to obtain optimal stratification. A small scale experimental program is undertaken to check the validity of the theoretical results. A single cylinder engine is used and direct injection systems designed to deliver the injection patterns, versus load and rpm, which the theory indicates should give optimal stratification. Various fuels are used and emissions and efficiency data recorded. The final goal is the achievement of guidelines for optimal stratification within the entire load-rpm range.

SUPPORTED BY U.S. Natl. Science Foundation

4.0039, ANHARMONIC OSCILLATOR LASERS

J.A. SMITH, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (DF036890; F44620-73-C-0059)

Systems based on flowing gas lasing media are a potentially important addition to the Air Force mission. This research investigates the use of the anharmonicity of the vibrational modes of molecules as a source of laser action. The non-equilibrium population of N2-CO-x mixtures in the throat and downstream in a supersonic expansion will be determined. Then the effects on performance of variation of parameters such as stagnation temperature, expansion ratios, thermal velocities, micture rations, etc., will be determined in order to optimize the system.

Supporting agency address information: AF Office of Scientific Research NPP, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0040, RELIABILITY EVALUATION OF C/MOS TECHNOLOGY IN COMPLEX INTEGRATED C
C. WHELAN, Radio Corporation of America, *Somerville, New Jersey* 08876 (DF735070; F30602-73-C-0282)

To investigate and determine basic failure mechanisms associated with C/MOS technology as applied to gates, shift registers, and memories. Representative C/MOS devices incorporating latest state-of- the-art technology including small quantities of radiation hardened devices, if available, which utilize aluminum oxide, chrome doped oxide and silicon nitride in the gate region will be used as test vehicles and will be subjected to a series of stress tests. These will include, but not be limited to the following tests--package gas analysis before and after stress, static bias with on-off cycling, temperature cycled step stress minus 55 degrees centigrade to plus 125 degrees centigrade with bias applied, operational life and thermal shock.

A comprehensive analysis will be performed on failed devices to determine the predominant failure mechanisms. These results will be used by the contractor to develop reliability prediction techniques, screening and qualification procedures for C/MOS devices and to assess the long term reliability of complex MOS memories as related to dormancy conditions in which the device sees no stress or very low levels of operational stress.

Supporting agency address information: Rome Air Development Center RBR, Griffiss AFB, NY 13440

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0041, THEORETICAL RESEARCH ON VISCOUS INTERACTIONS
M.H. BLOOM, Polytechnic Inst. of New York, School of Engineering, *Brooklyn, New York* 11201 (DF028870; AF-AFOSR-2635-74)

In order for the AF to improve flight vehicles in the future so that their operational capabilities will be superior to those of any potential enemy, new aerodynamic prediction methods are needed. The performance of such vehicles depends on the ability of the engineer to predict the forces, moments, heat transfer rates, etc., acting on the aerodynamic shape of the vehicle. Present prediction methods are only able to solve simplified shapes and deal with ideal gases and assumed models of viscosity, turbulence, etc. This research continues to refine methods for handling three-dimensional flows, viscous-inviscid interactions, cross flow boundary layers and transient behavior of flows. Recent work by Piny has led to new analytic and numerical approaches in three-coordinate flow problems and viscous interactions. In addition to extending and generalizing this work, more efficient numerical methods are being evaluated.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0042, THE CONTROL OF POLYSYSTEMS
R.F. DRENICK, Polytechnic Inst. of New York, School of Engineering, *Brooklyn, New York* 11201 (ENG74-24722)

The theory emerging from this research as well as previous work is essentially a generalization of classical control theory. It is not restricted to linear systems and to small plant uncertainties and will lead to controllers which are feedback controllers in general. The controllers typically incorporate a novel feature sometimes called a 'zone of indifference' in mathematical economics. In the present context, the controller remains indifferent to certain feedback signals, namely those which indicate the system response is already sufficiently close to the desired one, considering the uncertainties of the situation, and no change in the control signal is called for. It is hoped that this research will help bridge the gap between theory and practice by selecting problems drawn from modern control engineering, as now practiced in industry, and studying the changes that could be made in the theory in order to be applicable to these problems.

SUPPORTED BY U.S. Natl. Science Foundation

4.0043, ANALYSIS OF EXPERIMENTS ON HYDRODYNAMICS INSTABILITY IN THE ABSENCE OF GRAVITY
J.B. KELLER, New York University, School Science & Engin., *New York, New York* 10003 (NSG 3059; 750-01-51)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0044, AN INVESTIGATION OF UNSTEADY STALL PHENOMENON ON A SLENDER ELLIPTIC CYLINDER 10157-E
J.C. WILLIAMS, Univ. of North Carolina, School of Engineering, *Raleigh, North Carolina* 27600 (DA0D8939; DAHC04-75-G-0007)

The objective of this research effort is to determine the effects of turbulence on the lift-angle-of-attack hysteresis curve for an oscillating cylinder of elliptic cross-section. This research effort is directly relevant to the dynamic stall problem on retreating helicopter rotor blades and supplements the work being done in-house at both the Ames and Langley Directorates of AMRDL.

A turbulent boundary layer on an oscillating elliptic cylinder of infinite span will be numerically calculated, starting from some transition point, realistically estimated, subject to an imposed pressure gradient determined in the absence of a wake.

Supporting agency address information: AMC Army Research Office ARO-D, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0045, COMPUTER-CONTROLLED LINKAGE SYSTEMS FOR LOCOMOTION AND MANIPULATION
H. HEMAMI, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (ENG74-21664)

This research effort involves a continuation of a research program in modelling and computer control of linkage systems for locomotion and manipulation. The research proposed encompasses five specific topics as follows: 1) basic theory of manipulation and legged locomotion in animals and machines, 2) television-computer analysis of human gait, 3) microcomputer-control of the knee joint in a long leg brace, 4) interactive computer-control of an orthotic arm for quadriplegics, and 5) computer-control of a six-legged vehicle for operation in hostile environments. Primary emphasis will be given to the areas of research that are common to problems of prosthetic devices and industrial manipulators.

SUPPORTED BY U.S. Natl. Science Foundation

4.0046, IMPROVED DESIGN TECHNIQUES FOR LOW NOISE CORRUGATED HORN ANTENNAS
L. PETERS, Ohio State University, School of Engineering, *Columbus, Ohio* 43212 (GK-40489)

The goal of this research is to obtain design data for the corrugated horn, a broad band, very low back lobe antenna. Emphasis is to be focussed on determining the losses, VSWR and back lobes of these structures with a sufficient accuracy so that the user could design an antenna to fit his particular needs. The many applications of this antenna include use in remote sensing, communications, and radar systems.

SUPPORTED BY U.S. Natl. Science Foundation

4.0047, FREE CONVECTION HEAT TRANSFER IN ENCLOSURES
M.C. JISCHKE, Univ. of Oklahoma, School of Engineering, *Norman, Oklahoma* 73069 (ENG74-18033)

The objectives in this research are to develop calculational methods which will allow determination of the steady state free convection heat transfer and flow fields in enclosures and to explain the occurrence of secondary motions in free convection flows in such enclosures. Attention will be focussed on the practically important case of high Grashof number where the asymptotic methods of boundary layer theory can be employed through the method of matched asymptotic expansions. As a precursor to attacking the turbulent flow problem, the present work will be

confined to laminar flow. Steady state heat transfer calculations will be carried out for three different geometries: (1) rectangular enclosures; (2) cylindrical annulus; and (3) spherical annulus. In each case, the core temperature and velocity profiles will be determined, and the origins of observed secondary motions which give rise to multicellular flow patterns will be examined by investigating the linear stability of the stratefied shear flow in the core. The results of these calculations will be compared with experimental measurements available in the literature.

SUPPORTED BY U.S. Natl. Science Foundation

4.0048, EXPERIMENTAL STUDY OF TRANSPORT AND THERMODYNAMIC PROPERTIES NEAR CRITICAL POINTS

T.W. MIHALISIN, Temple University, School of Liberal Arts, *Philadelphia, Pennsylvania* 19122 (DMR72-03172 A02)

The investigations supported by N.S.F. Grant No. GH-34651 will be continued and some new research will be initiated. The studies on the effects of finite size on critical phenomena will be continued by investigating films on nickel with various thicknesses. The ultrasonic measurements on materials with soft mode transitions, especially SrTiO3 and KMnK3, will be continued, as will the measurements of thermal expansion of ferroelectric TGS. The new studies will be on induced magnetic moment systems such as Pr3Tl. High field magnetization, specific heat, transport properties and susceptibility measurements around the magnetic critical point will be used to deduce the effects of the crystalline electric fields in these materials.

SUPPORTED BY U.S. Natl. Science Foundation

4.0049, RESEARCH IN LARGE ADAPTIVE ANTENNA ARRAYS

R.S. BERKOWITZ, Univ. of Pennsylvania, School of Engin. & Appl. Sci., *Philadelphia, Pennsylvania* 19104 (NSG 5064; 650-60-11)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

4.0050, THERMAL ENERGY STORAGE

F.W. SCHMIDT, Penn. State University, School of Engineering, *University Park, Pennsylvania* 16802

The parameters which characterize the transient behavior of a sensible heat thermal storage unit are being determined. Curves and tabulated results which relate the exit fluid temperature; the heat capacities of the fluids; the heat transfer characteristics of the flow as indicated by the Biot numbers for fluids; the geometry of the storage matrix; the material used in the construction of the storage matrix and nondimensional time are presented.

The energy equation for the fluids and the transient conduction equation for the storage material will be solved using finite difference techniques. An experimental program is being conducted and the predicted and experimental results will be compared to obtain an assessment of the accuracy of the prediction techniques.

The results of this study will be used by those involved in energy management to predict the thermal behavior of system using sensible heat thermal storage and to evaluate the economic feasibility of energy systems containing these types of units. It will also assist the designer in the sizing of these types of storage units.

SUPPORTED BY Pennsylvania State University

4.0051, ROBOT COMPUTATIONS FOR ORIENTING WORKPIECES

J.R. BIRK, Univ. of Rhode Island, School of Engineering, *Kingston, Rhode Island* 02881 (APR74-13935)

Programmable industrial robots are a new form of technology with widespread applications. Prospects are high for improving industrial robot technology in the near future. A major deficiency of current robots used in manufacturing is their inability to grab a workpiece from a disorganized supply, to orient it, and then to insert it into a fixture. The orientation subproblem will be emphasized in this project.

The major objective of the research is to develop general techniques for orienting and handling industrial workpieces in a batch production environment. An adaptive materials handling system may consist of one or more multiple degree-of-freedom manipulators and a vision system. Many technical problems remain to be solved to fully utilize this kind of system. A number of these problems will be investigated. 1) Identification of workpiece orientation within the gripper is frequently important. To achieve this, at least three distinct noncollinear features on the workpiece need be located. This will be done using structured illumination and using visual processing algorithms. 2) Specification of the desired orientation and position of the workpiece. 3) Ease of programming. A visual programming device will be used. 4) Quick set-up and functioning of the material handling system. A set of lights attached to the work stations will be introduced to provide a reference system avoiding manipulator-station alignment problems.

SUPPORTED BY U.S. Natl. Science Foundation

4.0052, FINITE ELEMENT ANALYSIS OF MAGNETIC FIELDS

E.B. BECKER, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: The accurate prediction of the magnetic field is essential for the rational design of rotating electrical machinery. The finite element method is being employed to calculate the distribution of magnetic fields in proposed designs of both slow and fast discharge homopolar generators which are used as pulsed power supplies for controlled fusion experiments.

SUPPORTED BY Texas Atomic Energy Res. Fdn. - Fort Worth

4.0053, FREE PERIODIC OSCILLATIONS OF A CIRCULAR RING

L.R. MACK, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: General formulation of the nonlinear equations of motion of thin circular rings is applied to obtain the frequency and mode shape for periodic free oscillations, both of the flexural type and of the quasi-inextensional type. Particular attention is directed toward the lower modes. The relative influence of various nonlinear terms--stretching and curvature, inertia, and bending--is sought. An inter-mode resonance phenomenon which may occur at discrete values of the thickness parameter requires a modification of the general solution procedure.

SUPPORTED BY University of Texas

4.0054, MIXED FINITE-ELEMENT APPROXIMATIONS IN STRUCTURAL MECHANICS

J.T. ODEN, Univ. of Texas, School of Engineering, *Austin, Texas* 78712 (DF038420; AF-AFOSR-2660-74)

AF flight vehicles will require improved performance to meet future mission profiles. New structural analysis methods will be needed as part of this performance improvement requirement. This research project will investigate the properties of new, mixed finite-element models. Understanding of these properties is essential to the structural analysts in order to correctly interpret analysis results. In addition, such information is necessary to correctly define finite element models which provide stable and convergent solutions. This project will have as its objective the detailed study of mixed f-e models, investigating error estimates, convergence proofs, numerical stability criteria, and the choice of approximating dependent variables on solution consistency and stability. Both boundary value and eigen value type problems will be investigated.

Supporting agency address information: AF Office of Scientific Research NA, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0055, SOLAR CELLS FROM VAPOR-DEPOSITED FILMS

M.A. WILKOV, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: One difficulty in producing silicon semiconductor photovoltaic devices by vapor deposition has been the lack of quality in the vapor-deposited silicon films. It has been shown the growth of crystalline films without defects is possible if the substrate conditions controlling nucleation are considered. Research is currently underway to use controlled nucleation of vapor deposited silicon films to grow films suitable for use in a cheap solar electric device.

SUPPORTED BY University of Texas

4.0056, STUDY OF VIBRATING STRUCTURE USING REAL-TIME HOLOGRAPHY
C.H. YEW, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: This research is to develop a method for obtaining the mode shape of a three-dimensional structure using real time holography.

SUPPORTED BY University of Texas

4.0057, DEVELOPMENT OF A LIDAR POLARIMETER SENSOR FOR REMOTE DETECTION AND MONITORING OF OIL AND OTHER HAZARDOUS MATERIAL
UNKNOWN, Texas A & M University System, Graduate School, *College Station, Texas* 77843 (045017 (TRAIS NO.))

The tasks involved for the development of a Lidar Polarimeter Sensor are: Prototype Optical Subsystem Design, Construction and Testing, Laboratory Measurements, Verification of Teflon and Dye Versus Water of Laboratory Model, Data Analysis, Analytical Modeling, Data Processing Algorithm Evaluation, Electronic System Concept Development, Signal Conditioner Design, Construction and Operational Testing, Data Processor Design, Construction and Operational Testing, System Integration and Operational Testing, Field Test Program, Project Evaluation, Reports and Documentation.

Document provided to S.S.I.E. by the T.R.A.I.S.

SUPPORTED BY U.S. Dept. of Transportation - Coast Guard

4.0058, FLOW PREDICTION OF A SEPARATING BOUNDARY LAYER PRODUCED BY AN ADVERSE PRESSURE GRADIENT
R.L. SIMPSON, Southern Methodist University, School of Engineering, *Dallas, Texas* 75222 (DA0B5575; DAHC04-75-G-0051)

To provide a more accurate means of predicting the occurrence of boundary layer separation, including the coupling effects between the boundary layer, the free-stream potential flow, and the separated flow region. Relevance - the problem of boundary layer separation in an adverse pressure gradient flow is an important factor in the design of many devices such as jet engines, rocket nozzles, airfoils and helicopter blades, and even in the design of fluidic logic systems.

A hyperbolic set of momentum, continuity, and turbulent kinetic energy equations are used together with a modified law of the wall for describing the separating turbulent boundary layer. These equations are solved numerically for the separating boundary layer utilizing iterative techniques to account for the strong interaction between potential flow and viscous regime.

Supporting agency address information: AMC Army Rsch Office, (ARO- D), Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

4.0059, DYNAMIC TESTING OF COMPOSITE MATERIAL HELICOPTER TRANSMISSION HOUSING
C.E. BRADDOCK, Bell Helicopter Company, *Fort Worth, Texas* 76101 (DA0D3817; DAAJ02-73-C-0038)

To determine the effect of increased housing stiffness on extending gear and bearing life by reducing misalignment under load. The use of high modulus composite materials in helicopter transmission housings potentially can reduce the number of overhauls required and extend transmission lives on future Army aircraft.

A graphite/epoxy UH-1 transmission housing fabricated under a previous contract will be used in the assembly of a complee transmission. The transmission will be instrumented and run at varying power levels to evaluate gear tooth patterns, housing, deflections, and temperature distribution as a function of ouaut torque.

Supporting agency address information: AVCOM Eustis Directorate, US Army Air Mobility R&D Lab, Ft. Eustis, Va 23604

SUPPORTED BY U.S. Dept. of Defense - Army

4.0060, INTERFEROMETRIC MEASUREMENTS OF ABSORPTION AND REFRACTION IN THE SUBMILLIMETER RANGE
M. ZAFAR, Univ. Coll., *London, England, United Kingdom* (DF289210; AF-AFOSR-2448-73)

AF function - development of remote sensors. Deficiency - existing sensing devices in the submillimeter region exhibit deficiencies in resolution. Laser development in the infrared requires detailed knowledge of the type generated by high resolution interferometry. Research - it is proposed to develop the Michelson and Mach-Zender interferometers for the measurement of refractive indices of aqueous materials in the frequency band 30-100 kaysers. Absorption coefficients as well as refractive indices will be measured. Such work should aid in diagnostics of HCN and H2O which lase in this band, as well as in radar scatterometry and remote sensing. How research contributes - the effort aids in the understanding of the basic molecular physics which gives rise to infrared signals.

Michelson and Mach-Zender interferometers will be developed for the measuring of refractive indices of aqueous materials in the frequency band 30-100 kaysers. Absorption coefficients as well as refractive indices will be measured.

Supporting agency address information: European Ofc of Aerospace Rsch & Dvlpmt NRP, FPO New York 09510

SUPPORTED BY U.S. Dept. of Defense - Air Force

4.0061, A MATHEMATICAL ANALYSIS OF TURBIDITY CURRENT FLOW
W.D. PILKEY, Univ. of Virginia, School of Engineering, *Charlottesville, Virginia* 22903 (GA-36803A01)

Present theoretical descriptions of turbidity current flows are inadequate. The objective of this research is to develop a realistic characterization of this naturally occurring dynamic process based on turbulent boundary layer theory and application of relatively new computational methods. The resulting mathematical model will be constrained by or applied to field observational data on discrete turbidity flow deposits.

SUPPORTED BY U.S. Natl. Science Foundation

4.0062, RESEARCH INITIATION - THE OPTIMAL CONTROL OF PARTIALLY OBSERVED SYSTEMS SUBJECT TO AGING
C. WHITE, Univ. of Virginia, School of Engineering, *Charlottesville, Virginia* 22903 (ENG75-19692)

The purpose of the research is 1) to extend, in ways appropriate to its role as an optimization model, the formulation and the present theoretical and computational analysis of the newly formulated partially observed semi-Markov optimization problem, and 2) to initiate a preliminary investigation into the applicability and validity of the new optimization problem as an optimization model of important physical systems subject to aging, control, and partial observation, such as patient-physician interaction and machine maintenance and reliability.

SUPPORTED BY U.S. Natl. Science Foundation

4.0063, PULSE PROPAGATION AND SCATTERING IN RANDOM MEDIA
A. ISHIMARU, Univ. of Washington, School of Engineering, *Seattle, Washington* 98105 (ENG74-23540)

The problem of propagation and scattering of a short pulse in the atmosphere, the ocean and biological media, related to com-

munication, remote-probing, radar, lidar and ultrasonic imagery will be investigated. This study will consider the following specific areas: (a) coherent bandwidth, coherent time and two-frequency correlation function of the random scatterers and turbulence in the strong fluctuation case. (b) Distortion of pulse shape due to the randomness in terms of time delay, pulse width broadening, rise time and long tail. (c) The fourth order moments of multifrequency waves and intensity fluctuations. (d) The effects of finite source and receiver sizes. (e) Remote-sensing of random medium by propagation and scattering techniques. (f) Limited ultrasonic experiments to verify the theoretical predictions.

SUPPORTED BY U.S. Natl. Science Foundation

4.0064, ANALYSIS OF FIXED-LEVEL BOUNDARY LAYER DATA
V.E. SUOMI, Univ. of Wisconsin, Graduate School, *Madison, Wisconsin* (OCD75-12941)

The objective of this research is to analyze portions of the boundary layer data obtained during the GARP Atlantic Tropical Experiment (GATE). The analysis is designed to evaluate the vertical transports of momentum, heat, and moisture as functions of the turbulence scale size and spectrum. It is the intent of this study to monitor how these processes interact with larger scale convection.

The principal data to be analyzed were obtained from the tethered balloon and acoustic sounder systems developed at the University of Wisconsin.

SUPPORTED BY U.S. Natl. Science Foundation

GEOSCIENCES

Includes Geosciences (general); Earth Resources; Energy Production And Conversion; Environment Pollution; Geophysics; Meteorology and Climatology; and Oceanography. For Related Information See Also Space Sciences.

5.0001, PROPAGATION OF MILLIMETER RADIO WAVES
A.T. WATERMAN, Stanford University, School of Engineering, *Palo Alto, California* 94305 (DF241830; F19628-74-C-0013)

AF function - high data-rate communications. Deficiency - current communication frequency bands heavily allocated--new frequency bands are required for high data rate communications channels. Research - investigate the limitations imposed by the atmosphere on the utilization of millimeter waves for communications and also as a diagnostic tool for meteorological remote sensing. How research contributes - experimental and theoretical studies to obtain basic knowledge on atmospheric inhomogeneities, turbulence and precipitation as they affect the data rate of a communications channel will be conducted. Measurements at wavelengths of 8.6 millimeters and 2.9 centimeters will be conducted over a line-of-sight path of 17 miles using a receiving array consisting of nine elements spaced over a horizontal distance of approximately 80 feet (2800 wavelengths). The amplitude and relative phase of the transmitted signals are sampled at each element of the array. If there were no atmosphere present, the received wave would be approximately uniform in both amplitude and phase. From examining the fluctuations in the received signals at both wavelengths it is possible to determine the effect of the atmosphere on the propagated wave and also draw some inferences on the type of atmospheric anomolies which are producing the variations.

Supporting agency address information: AF Cambridge Research Laboratories LZ, L. G. Hanscom Field, Bedford, Mass 01730

SUPPORTED BY U.S. Dept. of Defense - Air Force

5.0002, NORTH PACIFIC EXPERIMENT (NORPAX) - REMOTE SOUNDING OF TEMPERATURE OF OCEAN SURFACE IN CLOUDY ATMOSPHERES
M.T. CHAHINE, U.S. Natl. Aero. & Space Adm., Jet Propulsion Laboratory, *Pasadena, California* 91109 (IDO74-13738 A01)

This experiment will apply a new technique for infrared remote sounding of the sea-surface temperature and the atmospheric temperature profile near the surface in the presence of multiple cloud layers in the fields of view. The experiment will also determine the relative importance of various sea and atmospheric parameters which affect the accuracy of the recovered sea-surface temperature. To do this, an infrared multidetector grating spectrometer will be modified. One H2O and three 15u channels will be added so as to have the same field of view as the other channels. This will enable measurements of outgoing radiance to be obtained from four sea surface temperature sounding channels in the 3.7u and 11.1u window regions, five atmospheric temperature sounding channels in the 6.3u region and from three cloud- sounding channels in the 15u region. The data analysis technique requires observations in adjacent fields of view of filter out the effect of clouds. This leads to the same degree of accuracy as is permitted under cloudless conditions. The instrument will be deployed by aircraft.

SUPPORTED BY U.S. Natl. Science Foundation

5.0003, DUAL-DOPPLER RADAR INVESTIGATION OF WIND FLOW PATTERNS IN METROMEX
E.E. GOSSARD, U.S. Dept. of Commerce, Natl. Oceanic & Atmos. Admin., *Boulder, Colorado* 80302 (AEN75-19217)

This is a proposal to use the NOAA dual-Doppler hardware and software system to measure the three-dimensional wind flow patterns over and downwind of the METROMEX complex in the St. Louis area and to extract divergence and vorticity information from the data. Also measured will be the location and frequency of first echoes and turbulent dissipation rate through the convective boundary layer and its capping inversion. NOAA has had considerable experience using the dual- Doppler system.

SUPPORTED BY U.S. Natl. Science Foundation

5.0004, TOWARD BETTER DEFINITION OF TORNADO & WATERSPOUT CHARACTERISTICS
E. KESSLER, U.S. Dept. of Commerce, Natl. Oceanic & Atmos. Admin., *Boulder, Colorado* 80302

Description: Research consists of determination of tornado and waterspout characteristics by direct measurement, photogrammetric methods, and by dual-Doppler radar measurements. Estimates of wind forces from damage assessment of engineered structures affected by tornadoes is also included. Work is conducted at the National Severe Storm Laboratory in Norman, Oklahoma.

Addenda: Estimated calendar year funding reported as 1975 $80,000.

SUPPORTED BY U.S. Nuclear Reg. Comm. - Washington, D.C.

5.0005, HYDRAULIC SENSOR INSTRUMENTATION
M. SCHERER, U.S. Dept. of Commerce, Environ. Research Laboratories, *Boulder, Colorado* 80302 (83337101)

Project objective: Develop remote sensor system capable of monitoring the shore face hydraulic regime. Current year plan: Data will be transmitted from the sensors by cable to shore where it will be recorded on magnetic tape in a form that can be directly transferred into a large digital computer for summarization and analysis. The work will constitute a test of direct line methods for inner shelf sensor systems.

SUPPORTED BY U.S. Dept. of Commerce - N.O.A.A.

5.0006, COORDINATED INVESTIGATION OF HIGH LATITUDE ELECTRON PRECIPITATION USING BALLOON, SATELLITE, AND SURFACE INSTRUMENTATION
J.R. BARCUS, Univ. of Denver, School of Arts & Sciences, *Denver, Colorado* 80210 (DES75-15662 A01)

This grant will support a research program involving coordinated efforts using balloon, satellite, and surface instrumentation for the investigation of a particular class of magnetospheric electron precipitation events. These events occur in the polar cap region (greater than 70 degrees geomagnetic), and they are due to processes in the earth's magnetotail which take place at distances well beyond those associated with effects at auroral latitudes.

The proposed program has been motivated by the results of studies of ionospheric absorption of cosmic radio noise observed during the night-time at high magnetic latitudes. Characteristically, these night- time absorption events are associated with magnetospheric substorms, yet the events tend to be more isolated in time, having rapid onsets (a few minutes rise time) and of rather short duration (approximately tens of minutes).

The principal aim of the proposed research then is to obtain more precise information on a relatively neglected phase of substorm evolution. Specifically, the following answers will be sought: What physical changes are taking place in the magnetotail which produce energetic electron precipitation into the polar cap region, and how does this knowledge contribute to the overall picture of the dynamics of the magnetospheric substorm?

SUPPORTED BY U.S. Natl. Science Foundation

5.0007, EFFECT OF UPSTREAM POWER PLANT DEVELOPMENT AND THERMAL LOADING ON WATER QUALITY CONTROL IN RESERVOIRS

T.W. KAO, Catholic University of America, School of Engineering, *Washington, District of Columbia* 20017 (ENG75-09347)

The effect of substantial thermal discharges on water quality in reservoirs and lakes will be studied in terms of the mixing processes and the dynamics of establishment of flows in reservoirs. Numerical, theoretical and experimental models will be studied, following the lines of previous work by the principal investigators. Numerical analyses will be made of an initial value problem based on the complete set of non-linear governing equations in a viscous diffusive stratified fluid. The results will be compared with laboratory and field observations.

SUPPORTED BY U.S. Natl. Science Foundation

5.0008, COMPOSITE FUELS FOR NUCLEAR REACTORS

J.H. RUST, Georgia Inst. of Technology, School of Nuclear Engineering, *Atlanta, Georgia* 30332

Description: This research is designed to measure thermophysical and mechanical properties of UO(2)-W composites. In addition, theoretical studies on heat transfer and reactor physics are to be performed. Irradiation experiments will be performed in the latter part of 1976. The composites show promise for a significant advance in fast reactor fuels.

SUPPORTED BY Georgia Institute of Technology - Atlanta

5.0009, RESEARCH ON FLAT PLATE SOLAR COLLECTORS EMPLOYING THE HEAT PIPE PRINCIPLE FOR HEATING AND COOLING OF BUILDINGS

W.B. BIENERT, Dynatherm Corporation, *Cockeysville, Maryland* 21030 (AER74-09164)

This project will study the feasibility of modular flat plate collectors employing the heat pipe principle to extract heat from the solar absorber surface and transport this heat to a primary fluid loop (either liquid or gas). The project will concentrate on the heat pipe collector surface and its interface with other module and system components. Existing research data on glazing, absorbing coatings and insulation will be utilized and not further developed in this project.

A submodule-size heat pipe solar collector will be designed, constructed and tested to determine the overall thermal impedence of a heat pipe solar collector. For this study, solar input will be simulated by electrical resistence strip heaters attached to the collector surface. A part of the submodule studies will be to identify possible failure mechanisms and conduct tests in which the processes leading to failure are accelerated. Based on the preceding studies, a full-scale module will be designed and fabricated and then tested under actual solar radiation. Parametric performance studies and economic analyses will be conducted as part of this program.

SUPPORTED BY U.S. Natl. Science Foundation

5.0010, NONPOTENTIAL AERODYNAMICS FOR WINDMILLS IN SHEAR-WINDS

I.. MORINO, Boston University, School of Engineering, *Boston, Massachusetts* 02215 (AER75-00548)

This project will investigate a general theory and numerical method for the analysis of aerodynamic flow fields in the presence of vorticity with application to windmills in shear-winds. The first goal of this research is to provide designers with a theoretical formulation which will explain the complex mechanisms of windrotor aerodynamics in the presence of vortices. The second goal is to provide a mathematical tool and computer program to determine the velocity and pressure distribution around the rotor blades by using a numerical solution of the exact equations that governs the interaction between the air and rotor blades. The method to be developed is an extension (and combination) of the techniques of potential flow aerodynamics and two dimensional vorticity and stream function methods. The resulting methodology will provide insight into the mechanism of windmill aerodynamics in the presence of vortices and provide a mathematical tool for the evaluation of the detailed velocity and pressure distributions.

SUPPORTED BY U.S. Natl. Science Foundation

5.0011, MONITORING FLOW PATTERNS AND SEDIMENT AND POLLUTANT DISPERSION WITH 24-CHANNEL SCANNER DATA

R.R. FRIESZ, U.S. Army, Waterways Experiment Station, *Vicksburg, Mississippi* 39180 (DA0F8186)

The Army must find methods for controlling pollution in domestic waterways resulting from discharge of wastewater by its various facilities. The overall objective of the proposed study is to develop procedures for monitoring flow patterns and sediment and pollutant dispersion of water bodies from digital tape data obtained with an aircraft-mounted Bendix 24-channel multispectral scanner. Specific objectives are to: (a) determine whether greater concentrations of suspended materials in streams can be discriminated with 24-channel data than with satellite data; (b) determine the minimum water surface area and width that can be detected with 24-channel data; and (c) determine whether water movement induced by tidal action or storms can be detected and monitored.

Existing 24-channel multispectral data obtained by NASA in the Chesapeake Bay area in support of the ERTS program will be used. Computer formatting, interpretation, and display procedures will be formulated to process the digital tape data. The data will be analyzed and evaluated for achievement of the objectives desired. The product of this study will be a draft report describing the results of the research, film transparencies keyed to maps of various scales, and computer printouts depicting spectrum matches of water bodies in the study area.

Supporting agency address information: OCE Waterways Experiment Station, PO Box 631, Vicksburg, Mi 39180

SUPPORTED BY U.S. Dept. of Defense - Army

5.0012, COMBUSTION OF MULTI-COMPONENT HYDROCARBON FUELS

I. GLASSMAN, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (AER75-09538)

In the current energy dilemma one of the major challenges facing the combustion field is to gather more information about the burning of liquid, multi-component fuels so that they can be burned cleanly and efficiently in most energy conversion devices, particularly in those automotive devices which hold promise to approach the fuel economy improvements put forth by the President as a national objective.

Most current and future combustion systems employ direct injection of multi-component fuels. This is of utmost importance to gain a better understanding of the fundamental processes of heterogeneous, unsteady, multi-dimensional, reacting flows for combustion design use.

Three tasks will be undertaken in this program. Task 1 is to develop algorithms by which fuel droplet vaporization, burning and nitric oxide formation rates can be predicted in situations where multi- component fuels are employed and the important effects of relative gas- liquid motion and liquid heat-up are taken into account. Task 2 is to expand the general data base available on high temperature reactions of realistic hydrocarbon fuel components and to develop and evaluate generalized, semiglobal kinetic mechanisms for specific classes of hydrocarbons for the

use in analytical modelling of combustion processes. Task 3 is to produce a detailed model for unsteady (and steady), two-dimensional, two-phase, turbulent reactive flows, to test it in several steady and unsteady combustors, and to disseminate its use to industry for optimal engine design.

SUPPORTED BY U.S. Natl. Science Foundation

5.0013, SAFETY ASPECTS OF HIGH-TEMPERATURE THERMAL ENERGY STORAGE SYSTEMS
O.H. BOSER, Philips Laboratories Division, *Briarcliff Manor, New York* 10510 (AER75-20605)

The rapid increase in world energy demand coupled with the diminishing energy resources and the source supply dilemmas dictate that maximum efforts be directed toward the improved utilization of available energy resources. In this regard, the storage of energy merits special attention because it makes load leveling and diurnal type inputs possible. Since the storage of electricity is as yet inefficient, thermal storage is of great interest, particularly storage which uses materials having extremely high capacities for heat. Certain eutectic mixtures of metal fluorides possess these properties and the feasibility for storage applications has been demonstrated both analytically and experimentally. A broad range of applications for this technology is possible where thermal storage units serving as energy reservoirs could be used for space heating, industrial furnaces and heat engines utilizing electrical, solar and other demand-availability sensitive energy sources.

However, before these salts can be used in buildings (and other) environments, the safety related problems associated with their use in high temperature thermal energy storage systems have to be investigated. The proposed investigation will determine the various chemical reactions that could occur between the various constituents of the system and the possible consequences of these reactions; it will determine safe methods of containing and thermally insulating the salts; also, it will recommend safety features to be incorporated into typical thermal energy storage systems in order to prevent or minimize the effects of chemical reactions.

SUPPORTED BY U.S. Natl. Science Foundation

5.0014, FLUID CORE AND OCEAN EFFECTS ON EARTH ROTATION
P. MCCLURE, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: The fluid portions of the earth give rise to inadequately understood free modes in its rotational and deformational motion and cause significant non-equilibrium effects in its response to the tide-generating potential. A theoretical model of fluid core and ocean effects is being developed for use in the interpretation of data obtained by laser tracking of artifical satellites and other methods.

SUPPORTED BY University of Texas

5.0015, ESTIMATION OF THE EARTH'S ROTATIONAL MOTION USING SATELLITE OBSERVATIONS
B.D. TAPLEY, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: Using the Earth's pole position data of the Bureau International de l'Heure, Mansinha and Smylie 1967 discovered an apparent correlation between the occurrence of major earthquakes and certain changes in the motion of the pole. However, using the International Polar Motion Service data, no conclusive evidence of a correlation was found. Because of the discrepancy between these two services of one to two meters, it is essential that polar motion determinations be made to greater accuracy. A program has been developed for estimating the position of the pole using observations of artificial satellites. Some of these observations are presently accurate to 0.5 meters in range and are expected to improve to 10 centimeters in the near future. This program generates simulated observations but will be adapted to process actual data.

SUPPORTED BY University of Texas

5.0016, SOLAR ENERGY COLLECTOR COMBINED WITH A HEAT PUMP
M.F. VANDERJAGT, Delft Univ. of Technology, *Delft, the Netherlands*

The project can be divided in the following subprojects: 1. Combination of solar heat collector with a heat pump. The objective is to improve the efficiency of a solar energy collector under the Dutch climatological conditions. 2. Calculation of the efficiency of heat pumps as a function of the temperature difference to be recovered, the temperature of the collector and the type of coolant. 3. Calculation of the economical applicability of space heating systems (floor-, ceiling- and central heating) coupled to solar heat collectors combined with a heat pump. 4. Making estimates about the energy conservation by improvement of building regulations (better insulation, influence of the window-surface, orientation with regard to the sun, etc.), by means of hybrid simulation methods. 5. Research on the efficiency of regenerators and recuperators.

SUPPORTED BY Delft Univ. of Technology - the Neth.

LIFE SCIENCES

Includes Life Sciences (general); Aerospace Medicine; Behavioral Sciences; Man/system Technology and Life Support; and Planetary Biology.

6.0001, ANALYSIS OF CELL WALL GROWTH IN PHYCOMYCES
R.I. GAMOW, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (BMS74-09881 A01)

Details of the nature of the growing cell wall of a developing sporangiophore are under study. A series of four experiments are underway that are all directed toward accomplishing this task. (1) By using a conical mirror the vertical and horizontal components of growth both during steady state growth and during a light growth response is being measured. (2) The changes in the distribution of light responsiveness in the growing zone during dark adaptation using starch particles as labels and ordinary photographic techniques is being measured. (3) Changes in the mechanical properties of the cell wall during a light growth response using a tensile test machine are being recorded. (4) The million volt electron microscope is being used in order to determine micro fibril orientation as a function of position in the growing zone.

SUPPORTED BY U.S. Natl. Science Foundation

6.0002, TRANSPORT PHENOMENA RELATED TO PROSTHETIC HEART VALVE THROMBUS FORMATION AND ERYTHROCYTE DAMAGE
J.R. LLOYD, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (ENG72-00280 A01)

This action provides additional funds and time extension for the committed renewal grant GK-39957X.

The objectives of this project are the development of in vitro experimental apparatus and diagnostic techniques which can be used to evaluate and understand the mechanism of erythrocyte damage and thrombus formation produced by prosthetic heart valves. This objective will be met by quantitative measurements of the local momentum and mass transfer characteristics associated with flow produced by prosthetic heart valves. Steady and pulsatile flow experiments with an electrochemical solution, water, and blood as the working fluids will be performed.

SUPPORTED BY U.S. Natl. Science Foundation

6.0003, EFFECTS OF SPACE FLIGHT ON CARDIAC FUNCTION
W.L. HENRY, U.S. Dept. of Hlth. Ed. & Wel., P.H.S. Natl. Insts. of Health, *Bethesda, Maryland* 20014 (Z01 HL 01622-01 CB)

The effect of prolonged space flight on the size and function of the heart is unknown. Using ultrasound, we measured the wall thicknesses, internal dimensions and the performance during blood ejection of the hearts of the Skylab 4 astronauts. Studies immediately following splashdown and subsequently over 68 days post-flight revealed no impairment of heart performance after 85 days in space.

SUPPORTED BY U.S. Dept. of Hlth. Ed. & Wel. - N.I.H.

6.0004, INVESTIGATION OF THERMAL ENERGY CONSERVATION BY REFLECTIVE LAYERS IN MULTI-LAYER CLOTHING SYSTEMS

R. PORTER, U.S. Army, Natick Laboratories, *Natick, Massachusetts* 01760 (DA0F4279)

Investigate the concept of reflectivity as a means of conserving the heat balance in clothing systems.

The guarded hot plate and the Cenco-Fitch apparatus will be used to investigate various permeable and impermeable reflective layers in clothing.

Supporting agency address information: TROSCOM Natick Laboratories, Natick, Ma 01760

SUPPORTED BY U.S. Dept. of Defense - Army

6.0005, CRASH CREW FIRE PROTECTIVE CLOTHING (SHIPBOARD)

C.J. ZEMME, U.S. Navy, Clothing & Textile Res. Unit, *Natick, Massachusetts* 01760 (DN543073)

To investigate and develop new lightweight reflective fabrics, insulating materials and clothing items for firefighters engaged in crash-rescue and shipboard damage control duties.

The approach will include the investigation of lightweight aluminized flame-proof outer fabrics and insulating materials, and the redesign and simplification of the various clothing components to improve wearer comfort, serviceability and mobility. The present gold- coated face shield material will also be investigated to improve its durability and chemical resistance to new fire extinguishing agents. Redesigned garments incorporating new materials will be procured and fleet tested.

Supporting agency address information: Naval Supply Systems Command 01A1A, Washington, D.C. 20360

SUPPORTED BY U.S. Dept. of Defense - Navy

6.0006, THE RESPONSE OF HEMATOPOIETIC STEM CELLS TO DIFFERENT LET DISTRIBUTION OF HELIUM ION BEAMS

H. ACETO, Coll. of William & Mary, School of Arts & Sciences, *Williamsburg, Virginia* 23185 (NSG 7073; 970-14-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

6.0007, NAVY ENVIRONMENT - NEUROPHYSIOLOGICAL AND BEHAVIORAL EFFECTS DUE TO MICROWAVE IRRADIATION

A.W. GUY, Univ. of Washington, School of Medicine, *Seattle, Washington* 98105 (DN223256; N00014-67-A-0103-0026)

An outstanding problem in the interaction of microwave energy with biological systems is one of determining at what level the interaction constitutes a hazard. In order to provide a better understanding of the hazards associated with microwave irradiation and a scientific basis for safety standards, it is proposed in this study to quantify the biological effects of cw and pulsed microwaves as well as their frequency and intensity dependence through controlled exposure of test animals.

The proposed research involves (1) a study of the effects of microwaves on the central nervous system with particular attention to the spinal cord using a segment of cord exposed in live cats; (2) the use of combined physiological and behavioral methods in primates, cats and rats. Primary emphasis will be on the interaction of microwave energy and the auditory system. Attempts will be made to determine the threshold of perception of audible microwave pulses. Information on mechanisms for this phenomenon will be sought using sequential ablation of structures of the auditory system of the cat.

Supporting agency address information: Office of Naval Research 441, Arlington, Va. 22217

SUPPORTED BY U.S. Dept. of Defense - Navy

MATHEMATICAL AND COMPUTER SCIENCES

Includes Mathematical and Computer Sciences (general); Computer Operations and Hardware; Computer Programming and Software; Computer Systems; Cybernetics; Numerical Analysis; Statistics and Probability; Systems Analysis; and Theoretical Mathematics.

7.0001, ANALYSIS OF MATHEMATICAL SOFTWARE FOR THE PURPOSE OF VALIDATION AND DOCUMENTATION

L.D. FOSDICK, Univ. of Colorado, School of Engineering, *Boulder, Colorado* 80302 (DCR75-09972)

The purpose of this research is to investigate software validation techniques based upon the previous research of the Principal Investigators. The research problems to be considered include automatic test data generation, automatic identification of execution paths, and quantitative program assessment in the sense of program quality measurement. Associated with this research is the use and modification of a data flow analysis system, called DAVE, to explore the underlying concepts in the area of software validation.

SUPPORTED BY U.S. Natl. Science Foundation

7.0002, NEW ALGEBRAIC METHODS IN THE ANALYSIS AND SYNTHESIS OF COMPLEX SYSTEMS 11554-RT

E.W. KAMEN, Georgia Inst. of Technology, School of Electrical Engin., *Atlanta, Georgia* 30332 (DA0D9124; DA-ARO(D)-31-124-73-G171)

This research will address the problem of extension of mathematical analysis of control systems to include time varying systems such as adaptive control systems, biological systems with time delays, and time- varying communication systems. Relevance - this research has the objective of extending and simplifying mathematical techniques for the analysis of systems such as intergrated circuits with lumped-distributed components, adaptive control systems, and communications systems with time-varying channels such as radio links, which are of interest to the Army.

The approach will be to express the input-output behavior of a multiterminal linear system in terms of an operational transfer function in the form of a matrix composed of polynomial operators. The resulting representation provides an algebraic framework which is computationally convenient since polynomial operator equations can be solved on a computer.

Supporting agency address information: AMC Army Research Office ARO-D, Durham, NC 27706

SUPPORTED BY U.S. Dept. of Defense - Army

7.0003, IMPROVED TECHNIQUES FOR SIMULATION EXPERIMENTATION WITH MULTIPLE-RESPONSE STOCHASTIC PROCESSES

W.E. BILES, Univ. of Notre Dame, School of Engineering, *Notre Dame, Indiana* 46556 (ENG74-19313)

The proposed research is concerned with the development of improved techniques for experimentation with models of systems which yield multiple responses where some or all of these responses are random variables. Four aspects of this problem will be examined: (1) A comparison of model formulation; (2) A comparison of several optimization methods; (3) Fundamental sampling studies; (4) An evaluation of criteria for terminating experimentation.

These studies will be applied to available mathematical models, representing a variety of applications in science and engineering, for which precise solutions are known using established Monte Carlo techniques to generate these simulated experiments.

Particular attention will be given in the proposed research to ways in which this methodology can be useful in energy studies. Mathematical models arising in the design, analysis, and control of energy systems will be selected for examination. Energy parameters will also be incorporated into models arising in other technology areas.

The expected product of this research is a set of procedures by which experimentation with multiple-response processes can be performed.

SUPPORTED BY U.S. Natl. Science Foundation

7.0004, DYNAMICS OF LINEAR AND NONLINEAR STRUCTURES COMPOSED OF NONPERIODIC UNITS
T.J. MCDANIEL, Iowa State University, School of Engineering, *Ames, Iowa* 50010 (GK-40589)

In this study, the computational advantages associated with linear periodic structures will be extended first to the analysis of nonperiodic linear structures and then to the analysis of nonlinear periodic and nonperiodic structures.

Specifically, this research program will consider: (1) Various approaches to obtaining approximate solutions to the governing linear difference or nonlinear differential-difference equations with variable coefficients. (2) The development of the theory of difference inequalities to determine the closeness of the approximate solutions to the (unknown) exact solution. (3) The rapid estimation of upper and lower bounds to the response of structures excited by deterministic or random dynamic loading.

SUPPORTED BY U.S. Natl. Science Foundation

7.0005, FUNCTION SPACE QUASI-NEWTON ALGORITHMS
W.F. POWERS, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (ENG74-21618)

This research program will investigate certain aspects of function space quasi-Newton methods.

The major goals are: (1) The development of convergence proofs and convergence rates for the methods, especially for singular optimal control problems. (2) The establishment of convergence criteria and procedures for quasi-Newton methods when the problem involves variable final time and penalty functions. (3) A study of the treatment of bounded control constraints by a transformation approach coupled with the quasi-Newton method.

The methods developed will be tested on simple illustrative problems. In addition, they will be tested on a relevant aerospace problem, namely the space shuttle orbital insertion with pitch rate as a bounded control function.

SUPPORTED BY U.S. Natl. Science Foundation

7.0006, MATHEMATICAL MODELLING AND IDENTIFICATION THEORY
W.L. ROOT, Univ. of Michigan, School of Engineering, *Ann Arbor, Michigan* 48106 (DF034780; AF-AFOSR-2328-72)

Effective and efficient control of any complex Air Force system is dependent upon adequate knowledge of the dynamical characteristics of that system. Insufficient prior knowledge of subsystem or component composition and performance necessitates application of an identification procedure, producing a mathematical model of the actual physical system which, in turn, permits design of the corresponding control system. Better methods of identification would provide significant improvement in existing system design and analysis capabilities. Objective of this research is to provide a unified theory and associated methodology for modelling and identification of unknown systems from input and output data. Four general research topics are being addressed--representations, stochastic systems, causal systems, and applications. Current emphasis is on developing a generalized mathematical representation structure for classes of stochastic systems (with attention to output noise and random internal perturbations as well as input noise) and to investigate problems of identifying such systems, on a systematic study of causal, slowly-time varying systems with potential application to on-line control situations, and on continued investigation of linear estimation theory and its application to identification.

Supporting agency address information: AF Office of Scientific Research NM, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

7.0007, TECHNICAL SEARCH AND PROCESSING OF ABSTRACTS INTO DOCUMENTS FOR EIGHT SPECIFIC FIELDS OF ENERGY
W.A. SHINNICK, Univ. of New Mexico, School of Business & Adm. Sci., *Albuquerque, New Mexico* 87106 (NAS 3-19434; 770-18-01)

SUPPORTED BY U.S. Natl. Aero. & Space Adm.

7.0008, NUMERICAL SOLUTION OF LARGE SYSTEMS OF ORDINARY DIFFERENTIAL EQUATIONS
J.J. BERTIN, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: Efficient algorithms are being developed for the numerical solutions of large systems of differential equations. Multistep methods with individual step-sizes for the differential equations, power series methods, extrapolation methods, and high-order Runge-Kutta methods are being developed and are being applied to the gravitational problem of N-bodies.

SUPPORTED BY University of Texas

7.0009, MODIFIED MULTI-STEP METHODS FOR STIFF DIFFERENTIAL EQUATIONS
J.J. BERTIN, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: The coefficients for multi-step methods are modified such that products of exponential functions and polynomials are integrated exactly. Thus, ordinary differential equations with 'stiff' characteristics can be integrated in an efficient manner.

SUPPORTED BY University of Texas

7.0010, NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS
D.G. BETTIS, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: New methods are being developed for the solution of ordinary differential equations which are characterized by rapidly varying functions. The coefficients for high order Runge-Kutta methods are being determined such that local truncation errors and function calls are minimized. Stability regions are maximized. The efficiency of these new algorithms is being investigated by applying them to a variety of problems.

SUPPORTED BY University of Texas

7.0011, OPTIMAL RUNGE-KUTTA INTEGRATION
D.G. HULL, Univ. of Texas, School of Engineering, *Austin, Texas* 78712

Description: Variable-step, Runge-Kutta integrators are being developed in which some of the parameters used to define the function evaluations are used to minimize the truncation error norm.

SUPPORTED BY University of Texas

PHYSICS

Includes Physics (general); Acoustics; Atomic and Molecular Physics; Nuclear and High-energy Physics; Optics; Plasma Physics; Solid-state Physics; Thermodynamics and Statistical Physics. For Related Information See Also Engineering.

8.0001, STUDY OF OPTICAL PROPERTIES OF TRANSITION METAL COMPOUNDS
C.Y. FONG, Univ. of California, School of Letters, *Davis, California* 95616 (DF035060; AF-AFOSR-2353-72)

Modern surveillance and detection systems as well as communications and guidance systems depend heavily upon solid state electronic devices. To insure the continued superiority of AF systems, the technology of materials, sensors and electronic components must be advanced. To do this it is necessary to learn more about the electronic structure and the excitation processes in selected solids. In particular we need to learn more about the transition metals and transition metal compounds which show great promise for new electronic devices. It is the purpose of this program to extend the non-local empirical pseudopotential method (NEPM) to transiton metal compounds, namely TiC, TiN, ZrC and ZrN. The NEPM techniques were used for the first

time for transition metals during the first year of the grant. Optical data for the above compounds are being measured for the first time in the visible and ultraviolet spectral region (1-6eV). This combined theoretical and experimental study is the first systematic study of a series of transition-metal compounds which is an open area of research because of the lack of an effective method in the past.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0002, CRYOGENIC PROPERTIES OF METALS
R.P. REED, U.S. Dept. of Commerce, Natl. Bureau of Standards, *Boulder, Colorado* 80302 (2750131)

Objectives: The objectives is to characterize the behavior of metals at low temperatures by definitive studies involving mechanical, thermal, and electrical property measurements or crystal or defect structure analysis.

Motivation: Rapid expansion in the fields of applied superconductivity and LNG storage and transportation demand sufficient knowledge of material properties at cryogenic temperatures to insure efficient design and proper material selection. Areas such as thermal and mechanical properties and magnet composite characterization are of immediate use to these industries.

Approach: Precise measurement equipment is available for thermal conductivity (2 to 295 K), electrical resistivity, magnetoresistivity, tensile prop., X-ray line profile analysis, fatigue crack growth rate (4-300 K), and fracture toughness (4-300 K). Supporting facilities include eddy-current decay apparatus, thermal expansion equipment, optical and electron microscopy facilities, and super-purity specimen preparation facilities. Emphasis is placed on well-characterized specimens and precision measurements. Characterization includes grain size, hardness, residual resistance ratios, dislocation density and stacking fault energy. New resonance measurement equipment has been assembled to measure composite elastic properties in the kilocycle range. Contracts to other research groups are awarded when cooperative research is most efficient.

Progress: The cooperative research program to study the substructure of iron meteorities between Ruff and Ives, Metallurgy Div., NBS, and our group has been completed. Several results were obtained: (1) a reliable portrait of the mechanical-thermal history of a meteorite (Tishomingo) was obtained and (2) a possible new hardening mechanism for martensitic ferrous alloys was proposed. A critical review and compilation of copper elastic properties has been completed. Three reviews summarize both polymers and metal base composite mechanical and thermal properties at low temperature. They will serve to direct future composite research toward potential use at 4 K in superconducting machinery. Research is continuing on superconducting magnet composite properties. Thermal expansion, thermal conductivity and isothermal elastic properties have been measured on selected composite cross- sections.

SUPPORTED BY U.S. Dept. of Commerce - N.B.S.

8.0003, THERMAL RESPONSE ANALYSIS
UNKNOWN, Kaman Corporation, *Colorado Springs, Colorado* 80907 (DF181920; F29601-74-C-0098)

To correlate structural response data obtained using the Snark and Owl electron beam facility with analytic predictions. The data will be generated with nine-inch diameter rings made of aluminum, graphite and carbon-carbon.

A structural response computer code representative of the current state-of-the-art in the analysis of rings subjected to in-depth heating will be used to generate analytic predictions.

Supporting agency address information: AF Weapons Laboratory DYV, Kirtland AFB, N Mex 87117

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0004, LASER INDUCED PLASMAS
D.R. KEEFER, Univ. of Florida, School of Engineering, *Gainesville, Florida* 32601

Description: In the application of high power lasers for cutting and welding, plasmas are often produced in the air near the surface of the materials. The resulting absorption of the laser radiation by the plasma reduced the power available at the surface. A theoretical and experimental investigation of this phenomenon has been undertaken to measure the properties of the plasma and to study the decay of the plasma when the laser radiation is removed. Spectroscopic and holographic measurements will be made of a plasma produced by a pulsed CO2 laser.

SUPPORTED BY University of Florida

8.0005, CONDENSED STATE OF MATTER AND ITS STUDY BY NEUTRON SCATTERING
AULUCK, Univ. of Delhi, *New Delhi, Delhi, India* (GF-34351)

Properties of matter in the condensed state will be studied under three headings: (1) thermal properties, especially of anisotropic solids-polymers, liquid crystals, and such highly anisotropic materials as pyrolytic graphite; (2) neutron scattering from anisotropic solids and from water and other liquids; and (3) thermalization of neutrons and their diffusion in various moderators,especially with regard to the discontinuous distribution of neutron scattering cross sections. Results are expected to clarify our understanding of the condensed state and may be useful in atomic reactor design.

SUPPORTED BY U.S. Natl. Science Foundation

8.0006, NITRIDE, CARBIDE SUPERCONDUCTING THIN FILMS
L. TOTH, Univ. of Minnesota, School of Chemistry, *Minneapolis, Minnesota* 55455 (DA0H3707; DAAK02-70-C-0181)

To develop film or bulk (tape or wire) superconductor material for applications requiring superconducting solenoids (electrical machinery and energy storage magnets). By 4Q FY74 cold rolling of niobium-aluminum tapes will be attempted.

Intermetallic compound targets will be metallurgically prepared and films of these materials sputter deposited. Bulk chunks of the same materals will be drawn in to wire form or cold rolled into tape form, possibly as copper composites. The superconducting characteristics will be determined and the structure analyzed by X-ray diffraction.

Supporting agency address information: TROSCOM Mobility Equipment Research and Development Center, Ft. Belvoir, Va 22060

SUPPORTED BY U.S. Dept. of Defense - Army

8.0007, DYNAMICS AND STABILITY OF SUPERCONDUCTING COIL SYSTEMS FOR FUSION REACTOR DESIGNS
F.C. MOON, Princeton University, School of Engineering, *Princeton, New Jersey* 08540 (AT(11-1)-2493)

The object of this research is to produce a computer code to predict the vibration and structural stability of a typical toroidal superconducting coil and coil system for proposed fusion reactors. This includes examination of the magnetoelastic stability and vibration of single coil; single coil in toroidal field; stability and vibration of a set of elastic superconducting coils in Tokamak configuration; and transient response of the structure to transient ground motion and to current transients. The analytical method used will be based on a variational or energy technique for magneto-mechanical systems.

Results: Vibration frequencies of a set of magnetically coupled descrete superconducting coils for a toroidal design as a function of magnet current, spacing and toroidal geometry, have been calculated. These frequencies show a decrease with current due to mutual attraction of neighboring coils.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - C.T.R.D.

8.0008, COLLECTIVE PROCESSES IN HIGH-BETA COLLISIONLESS PLASMAS
W.C. FELDMAN, Los Alamos Scientific Lab., *Los Alamos, New Mexico* 87544

Description: This basic plasma physics research project is devoted towards a fuller understanding of turbulent high-beta collisionless plasmas by studying the stability of electron and ion velocity distributions measured in the interplanetary medium. The argument for doing the space plasma theory first is based on the fact that experimental data measured in space is far more complete than any laboratory-based plasma measurements. This is because an entire spacecraft is smaller than a Deybe length (not possible in the laboratory) which enables highly detailed measurements on the undisturbed interplanetary plasma. Our first specific objective is to understand the nature, evolution and saturation mechanism of heat flux driven instabilities in collisionless plasmas. Such an understanding is important towards achieving fusion in laser-pellet devices. The method employed in this study is to use measured solar wind electron and ion velocity distributions to determine the dominant locally active kinetic processes which are capable of affecting the plasma conductivity. Indeed, measured plasma configurations have been found to be marginally stable with respect to the electromagnetic ion cyclotron, magnetosonic and electron whistler wave modes and the resultant effects on the plasma conductivity are being studied.

Addenda: Estimated calendar year funding reported as 1975 $50,000.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - P.R.D.

8.0009, STRUCTURE-DEPENDENT PROPERTIES OF THIN FILM SUPERCONDUCTORS

J.M. DICKEY, City University of New York, School of Liberal Arts, *Flushing, New York* 11367 (DF034400; AF-AFOSR-2292-72)

New approaches to Air Force guidance, navigation, remote sensing, and detection of electromagnetic radiation depend upon new solid state superconducting devices. This research investigates the relationship between the structure of surface layers of superconducting compounds and their critical transition temperatures. Thin films of superconducting metals are needed for low-loss, high q microwave resonant cavities and for other high-frequency devices. Thin films of type II superconducting compounds, such as niobium-tin or niobium-aluminum, are formed by evaporation of one component onto a single crystal or foil of the other component and reacted at an appropriate temperature. In situ low-energy electron diffraction analyses are made of the atomic structure and constitution of the thin film surfaces. Correlations are made with the transition temperature of the superconducting compound. From such structure-dependent relationships more desirable superconductors having higher transition temperatures may be obtained for application to novel superconducting devices.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

8.0010, NONLINEAR BEHAVIOR OF UNSTABLE PLASMA IN THE THRESHOLD REGIME

A. SIMON, Univ. of Rochester, School of Engineering, *Rochester, New York* 14627 (AT(11-1)-3497)

We will extend the nonlinear threshold theory of the collisionless drift instability to include sheared magnetic fields and also to the localized mode case. The method will also be applied to trapped electron modes. Finite-Beta effects will be included in the linear theory of the trapped electron modes, in the presence of sheared fields. Nonadiabatic effects on motion of ions in moderate-Beta mirror machines will be studied. A theory of delayed e.m. radiation following termination of intense laser pulses will be developed.

Results: A general theory of threshold non-linear saturation behavior plus analyses of 7 plasma instabilities and comparison with experiments. A total of 10 journal articles plus one pending. Six Ph.D. students produced plus four in progress.

SUPPORTED BY U.S. Energy Res. & Dev. Admin. - C.T.R.D.

8.0011, ATOMIC FLUORESCENCE AND HIGH RESOLUTION ATOMIC ABSORPTION SPECTROMETRY

C. VEILLON, Univ. of Houston, School of Arts, *Houston, Texas* 77004

The continuous-sample-introduction graphite tube furnaces have proven to be sensitive, reproducible and extremely stable atomization systems for atomic fluorescence spectrometry (AFS) and atomic absorption spectrometry (AAS). A methane pyrolysis treatment allows continuous operation and indefinite tube life. A dispersive AFS system employing high intensity electrodeless discharge lamp (EDL) line sources has been developed and has been used to establish the mole ratio of Zn in the metalloenzyme RNA polymerase. A nondispersive AFS system has been developed for determinations of elements at the picogram level with extremely simple instrumentation. The non-flame AAS system appears to be an excellent means of investigating matrix effects, and high temperature reactions and equilibria. The high resolution interferometer system has been found to be state-of-the-art limited in terms of suitable multilayer dielectric reflective coatings in the UV region. The desired resolution was obtained, but the coatings do not cover a sufficiently large spectral region to completely overcome the one-source-per-element limitation of AAS. A dispersive, continuum source AFS system has been developed which shows greater promise in overcoming the above limitation of AAS, as well as the scattering problem common in AFS.

SUPPORTED BY Robert A. Welch Found. - Houston, Texas

8.0012, ELECTRONIC STRUCTURE OF DISORDERED SOLIDS

E.H. STERN, Univ. of Washington, School of Arts, *Seattle, Washington* 98105 (DF026430; AF-AFOSR-1967-71)

The aerospace functions of electronic communications, remote sensing, and visual display rely upon electronic structure, optical properties, surface effects, and magnetic behavior of materials used in solid state devices. This research is mainly concerned with the electronic structure and properties of disordered metals. Besides metal alloys, amorphous solids, and liquid metals, this includes systems with surfaces, point defects, stacking faults, dislocations and imperfections. Experimental measurements of the polar reflection Faraday effect and ordinary optical constants are used to obtain the shape of the Fermi surface and the character of the new optical absorption introduced by disorder. Studies in disordered alloys of the effect of varying the electron per atom ratio, the valence of the solute and the type of metal host are made. Amorphous metals are studied by these same techniques to investigate if a Fermi surface and its shape can be defined. Experimental studies of second harmonic production of light at metal surfaces are conducted to yield new information on the physics of surfaces. Variations in the work function as a function of composition are measured in order to estimate screening lengths in metal alloys.

Supporting agency address information: AF Office of Scientific Research NE, 1400 Wilson Blvd, Arlington, Va 22209

SUPPORTED BY U.S. Dept. of Defense - Air Force

SPACE SCIENCES

Includes Space Sciences (general); Astronomy; Astrophysics; Lunar and Planetary Exploration; Solar Physics; and Space Radiation. For Related Information See Also Geosciences.

10.0001, GEOPHYSICAL FLUID DYNAMICS

J.W. MILES, Univ. of California, School of Engineering, *San Diego, California* 92038 (DES74-23791)

This project will continue research in geophysical fluid dynamics in the La Jolla Laboratories of the Institute of Geophysics and Planetary Physics. The principal topics will be: (a) theoretical studies of tides and planetary waves in the terrestrial and other (especially Jovian) planetary atmospheres, (b) theoretical studies of internal tides in the ocean, (c) theoretical studies of equatorial currents and waves, (d) theoretical, and possibly experimental, studies of harbor resonance, and (e) experimental studies of wake collapse in rotating fluids.

SUPPORTED BY U.S. Natl. Science Foundation

10.0002, THEORETICAL ASTROPHYSICS
D.D. CLAYTON, Rice University, Graduate School, *Houston, Texas* 77001 (MPS74-20076)

The theroretical research in astrophysics being supported includes: 1) studies of explosions on white dwarfs to produce dwarf novae and the possible nucleosynthesis; 2) s-process studies, especially new exact calculations and theorems concerning the mathematical problem; 3) massive star explosive nucleosynthesis research; 4) investigations to predict the flux of gamma rays from stars; 5) studies of nuclear cosmochronology; 6) research on thermonuclear processes in stars; 7) work on the formation of metal enhanced stars; 8) studies of the evolution of entire galaxies, especially their chemical evolution, star population, and gas content.

This is a continuation of work previously supported by NSF grant GP-18335-002.

SUPPORTED BY U.S. Natl. Science Foundation

10.0003, LOW ENERGY CELESTIAL GAMMA RADIATION
R.C. HAYMES, Rice University, School of Engineering, *Houston, Texas* 77001 (MPS73-04785 A01)

Several extragalactic and galactic gamma-ray sources will be observed. The virtually-unexplored wavelength band which includes the radiations of excited atomic nuclei will receive special emphasis. This band, extending from 0.1 MeV to 10 MeV in photon energy, will provide new and fundamentally different information about the nature of the most powerful celestial objects known. In particular, the energy mechanisms driving these objects, which may be the sites of nucleosynthesis and of antimatter, will all yield unique spectral features within the bandpass of the instrument. The first probable detection of nuclear line radiation from beyond the solar system have been made, and now a new gamma-ray telescope of yet better sensitivity and bandwidth will be flown. Observations will be made from South America where the galactic center, Vela pulsar, and other southern hemisphere objects may be observed.

This is a continuation of work previously supported under NSF grant GP-40835.

SUPPORTED BY U.S. Natl. Science Foundation

10.0004, COLLISIONS INVOLVING HELIUM ATOMS IN HIGH RYDBERG STATES
R.F. STEBBINGS, Rice University, School of Engineering, *Houston, Texas* 77001 (MPS74-11690 A02)

A study of a variety of collision processes involving highly excited helium atoms will be continued. These atoms will be produced by irradiating helium 2S1 and 2S3 metastable atoms with the output beam of a tunable laser. With appropriate wavelength selection a single high Rydberg level may be selectively populated. With available lasers it is possible to excite both nP1 and nP3 levels over a large range of principal quantum number n. At the present time there appears to be no published experimental data pertinent to collisions involving such atoms and activity in this area is thus timely. Apart from their intrinsic interest many properties of highly excited atoms are needed for a detailed understanding of recombination and ionization balance in stellar atmospheres and in laboratory plasmas.

This work is a continuation of that currently supported by Foundation grant GP-44176X1.

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N75-28003*# Lockheed-Georgia Co., Marietta.
THEORETICAL AND EXPERIMENTAL STUDY OF A NEW METHOD FOR PREDICTION OF PROFILE DRAG OF AIRFOIL SECTIONS
S. H. Goradia and D. E. Lilley Washington NASA Jun. 1975 166 p refs
(Contract NAS1-12170)
(NASA-CR-2539) Avail: NTIS HC $6.25 CSCL 01A

Theoretical and experimental studies are described which were conducted for the purpose of developing a new generalized method for the prediction of profile drag of single component airfoil sections with sharp trailing edges. This method aims at solution for the flow in the wake from the airfoil trailing edge to the large distance in the downstream direction; the profile drag of the given airfoil section can then easily be obtained from the momentum balance once the shape of velocity profile at a large distance from the airfoil trailing edge has been computed. Computer program subroutines have been developed for the computation of the profile drag and flow in the airfoil wake on CDC6600 computer. The required inputs to the computer program consist of free stream conditions and the characteristics of the boundary layers at the airfoil trailing edge or at the point of incipient separation in the neighborhood of airfoil trailing edge. The method described is quite generalized and hence can be extended to the solution of the profile drag for multi-component airfoil sections. Author

N75-28004*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PROCEDURES FOR THE DESIGN OF LOW-PITCHING-MOMENT AIRFOILS
Raymond L. Barger Washington Aug. 1975 22 p refs
(NASA-TN-D-7982; L-10114) Avail: NTIS HC $3.25 CSCL 01A

The pitching moment of a given airfoil is decreased by specifying appropriate modifications to its pressure distribution; by prescribing parameters in a special formula for the Theodorsen epsilon-function; and with superposition of a thickness distribution and subsequent tailoring. Advantages and disadvantages of the three methods are discussed. Author

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N75-28005*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 57
May 1975 96 p refs
(NASA-SP-7037(57)) Avail: NTIS $4.00 CSCL 01A

This bibliography lists 306 reports, articles, and other documents introduced into the NASA scientific and technical information system in April 1975. Author

N75-28006 Maryland Univ., College Park.
THE INFLUENCE OF FLOW ORIENTATION ON THE VORTEX FREQUENCIES OF BLUFF CYLINDERS AT LOW REYNOLDS NUMBERS Ph.D. Thesis
Donald Thomas Knauss 1974 134 p
Avail: Univ. Microfilms Order No. 75-14305

The various Reynolds number regimes of bluff body flow, as delineated by the afterbody flow pattern, are reviewed. The evolution of the theory of fully separated flows, which relates cylinder geometry and wake width to the form drag, is also presented. The utility of the Strouhal number in predicting the relative drag of various two-dimensional bluff shapes is discussed, and an empirical correlation for the variation of Strouhal number with pressure drag coefficient is redeveloped from the original sources, and is shown to be valid for a wide variety of bluff shapes. It is in good agreement with a similar correlation given in the literature. A detailed survey of investigations relating to the variation of shedding frequencies with angle of incidence is presented. The resulting data show how the Strouhal number and dimensionless frequency of an elliptical cylinder vary with flow incidence angle in the Reynolds number range between 300 and 1200. Dissert. Abstr.

N75-28007 Virginia Polytechnic Inst. and State Univ., Blacksburg.
PREDICTION OF THE STEADY AERODYNAMIC LOADS OF LIFTING SURFACES HAVING SHARP-EDGE SEPARATION Ph.D. Thesis
Osama A. Kandil 1974 165 p
Avail: Univ. Microfilms Order No. 75-15877

A nonplanar discrete-vortex technique was developed. The method is capable of obtaining the shapes of the wakes emanating from the sharp edges (e.g., the trailing edge, wing tip, and leading edge) as part of the solution. The distributed and total aerodynamic loads on the lifting surfaces were predicted without restrictions on aspect ratios, angles of attack (as long as vortex bursting or boundary-layer separation on the wing surface did not occur), and planforms. The effect of thickness and level angle of the sharp edges was taken into account using two nonplanar vortex lattices; one on each surface of the wing. The technique was extended to solve the problem of interacting lifting surfaces. Rectangular, swept-back, and delta wings are presented as numerical examples. The results show the problem of interacting lifting surfaces to be in qualitative agreement with the experimental observations. Dissert. Abstr.

N75-28008*+ National Aeronautics and Space Administration, Washington, D.C.
AERONAUTICAL ENGINEERING: A SPECIAL BIBLIOGRAPHY WITH INDEXES, SUPPLEMENT 56
Apr. 1975 134 p refs

(NASA-SP-7037(56)) Avail: NTIS HC $4.00 CSCL 01A

This bibliography lists 439 reports, articles, and other documents introduced into the NASA scientific and technical information system in March 1975. Author

N75-28009+ Office National d'Etudes et de Recherches Aerospatiales, Toulouse (France).

TRIDIMENTIONAL BOUNDARY LAYER COMPUTATION APPLIED TO TURBOMACHINE WAKES. DIFFUSER OF CENTRIFUGAL COMPRESSOR Final Report [ELABORATION DE METHODES DE CALCUL DES COUCHES LIMITES TRIDIMENSIONNELLES EN VUE D'UNE APPLICATION AUX ECOULEMENTS DE TURBOMACHINES. CAS DU DIFFUSEUR DE COMPRESSEUR CENTRIFUGE]

R. Michel Sep. 1974 73 p refs In FRENCH; ENGLISH summary

(Contract DGRST-72-7-0598)

Avail: NTIS HC $4.25

The establishment of integral and finite-difference methods of calculation of the three-dimensional turbulent boundary layers, taking into account the effect of a rotation of the walls, is discussed, as well as the application to the development of the boundary layer in a vaneless diffuser of centrifugal compressor. Determination of the effect of inlet angle and speed of rotation, especially on the radial separation, is covered. Treatment of the coupling between the boundary layer and the potential flow, and determination of the static pressure recovery are also included. Author (ESRO)

N75-28010# Weapons Research Establishment, Salisbury (Australia).

THE JOINT NOL/RAE/WRE RESEARCH PROGRAMME ON BOMB DYNAMICS. PART 4: THE EXTERIOR BALLISTICS OF BOMB DESIGN

F. J. Regan (NOL), J. H. W. Shannon, and F. J. Tanner (RAE) Dec. 1974 39 p refs

(WRE-Report-1319(WR/D)-Pt-4; NOLTR-74-58) Avail: NTIS HC $3.75

The task of the ballistician is discussed in the light of knowledge gained during the program, and the application of the techniques derived to missile design is illustrated. In addition, brief reference is made to a number of research projects which have stemmed from the original tripartite work. Author

N75-28011# Advisory Group for Aerospace Research and Development, Paris (France).

SPECIALISTS MEETING ON WING-WITH-STORES FLUTTER

Apr. 1975 134 p refs Partly in FRENCH and partly in ENGLISH Presented at 39th Meeting of the Struct. and Mater. Panel, Munich, 6-12 Oct. 1974

(AGARD-CP-162) Avail: NTIS HC $5.75

This conference proceedings consists of nine papers which deal with the difficult problem of wing store flutter. The latest state-of-the-art is examined, improved methods for avoiding restrictive placarding and for rapidly and economically evaluating the many possible store combinations are presented, and possibilities for optimizing the design procedure with regard to wing/store combinations are discussed. For individual titles, see N75-28012 through N75-28020.

N75-28012 Royal Aircraft Establishment, Farnborough (England). Structures Dept.

CALCULATION METHODS FOR THE FLUTTER OF AIRCRAFT WINGS AND EXTERNAL STORES

T. Niblett and J. C. A. Baldock *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 7 p refs (For availability see N75-28011 19-02)

Theoretical work at RAE on the wing-with-stores problem is reported which was in the fields of structural representation, the solution of the flutter equations and the prediction of flutter characteristics from structural properties. The subjects covered are: (1) a comparison of the normal modes calculated for a wing-with-stores from some of the normal modes of the bare wing and discrete-load modes with those calculated from the full flexibility matrix; (2) the basis of a computer program which traces the loci of constant flutter speeds when two structural parameters vary; and (3) the interpretation of the loci of constant flutter speed in terms of modal shapes and frequencies with the object of assessing the most critical store combinations. Author

N75-28013 British Aircraft Corp., Warton (England).

UK JAGUAR EXTERNAL STORE FLUTTER CLEARANCE

C. G. Lodge and M. Ormerod *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 24 p (For availability see N75-28011 19-02)

The flutter clearance of U.K. Jaguar using a combination of mathematical modelling, ground resonance and flight testing leading ultimately to clearance of a wide range of under wing stores. Some improvements in modal modelling techniques are outlined. These should enable reductions in future ground and flight testing times to be made. Author

N75-28014 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).

FLUTTER OF WINGS EQUIPPED WITH LARGE ENGINES IN POD

R. Destuynder *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 12 p refs In FRENCH; ENGLISH summary (For availability see N75-28011 19-02)

Calculations and measurements of unsteady aerodynamic forces performed in subsonic flow on a model equipped with an engine in pod showed that the interference between engine and wing remains negligible. It was also shown that the aerodynamic forces induced on the engine itself by its own oscillation are important and give a significant contribution to the generalized forces. Account was taken of these two remarks and the aerodynamic forces were calculated separately on the engine which was assimilated to a thin walled cylinder with internal and external flow in the axial direction. An application to a flutter case shows the importance of the contribution of the forces on the engine. A good agreement was obtained between theory and experiment at Mach number M - 0.80. Author

N75-28015 National Aerospace Lab., Amsterdam (Netherlands).

CALCULATION OF AERODYNAMIC LOADS ON OSCILLATING WING/STORE COMBINATIONS IN SUBSONIC FLOW

B. Bennekers, R. Roos, and R. J. Zwaan *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 13 p refs (For availability see N75-28011 19-02)

A method for the calculation of aerodynamic loads on wing-store configurations oscillating in subsonic flow is presented. In this method the linearized equation for subsonic compressible flow is transformed into two sets of integral equations for the steady and a superimposed unsteady flow field. The wing loads are represented by dipole distributions (wing thickness is neglected) and the store loads by source distribituons. Discretizing these distributions into lifting lines and source panels of constant strength results into a set of algebraic equations. These are solved for the unknown distributions by forcing the flow to be tangential to the surfaces of the oscillating wings and bodies in a set of control points. The solution enables the calculation of pressure distributions on the wings and stores and of generalized aerodynamic coefficients. Calculated results are presented and compared with experiments. Author

N75-28016 National Aerospace Lab., Amsterdam (Netherlands).

ANALYSIS OF MEASURED AERODYNAMIC LOADS ON AN OSCILLATING WING-STORE COMBINATION IN SUBSONIC FLOW

L. Renirie *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 15 p refs (For availability see N75-28011 19-02)

An analysis is given of aerodynamic loads measured with an oscillating wind tunnel model representing a wing with a tip tank and a removable pylon with store. Attention is paid to the interference effects on the wing load and to the pylon store load in low and high subsonic flow. Author

N75-28017 Messerschmitt-Boelkow G.m.b.H., Ottobrunn (West Germany).

WING WITH STORES FLUTTER ON VARIABLE SWEEP WING AIRCRAFT

O. Sensburg, A. Lotze, and G. Haidl *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Jul. 1945 19 p refs

(For availability see N75-28011 19-02)

Wing mounted stores with varying mass and inertia are discussed in conjunction with variable wing geometry for fighter aircraft. Modified branch mode techniques were used to obtain the frequencies and modeshapes of the coupled system. It is shown that only free dynamically scaled total aircraft models give good correlation when turning effects occur. F.O.S.

N75-28018 Aeritalia, Turin (Italy).
A PARAMETRIC STUDY OF WING STORE FLUTTER
L. Chesta *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 12 p refs (For availability see N75-28011 19-02)

The influence of different parameters on the flutter of wings with stores was studied in more than 3000 wind tunnel configurations. The parameters studied include store mass, store radius of inertia, store c.g., pylon pitch stiffness, and wing sweep angle. Results indicate: (1) Flutter is induced by the coupling of the wing fundamental bending and the store pitch modes. (2) Flutter speed decreases with increasing store radius of inertia until the frequency of the store pitch mode is higher than that of the fundamental bending. (3) For all sweep angles, the forward c.g. shifting produces a slight reduction of the minimum flutter speed. F.O.S.

N75-28019 Grumman Aerospace Corp., Bethpage, N.Y.
RECENT OBSERVATIONS ON EXTERNAL-STORE FLUTTER
Eugene F. Baird and William B. Clark *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 8 p refs (For availability see N75-28011 19-02)

The problem of wing flutter with external stores is discussed in terms of flutter-prevention when designing aircraft. General guidelines for the optimum arrangement of external stores on wings are given, and the mission-loading requirements for a new aircraft are considered. Other topics discussed include: pylons, flutter-model tests, ground vibration tests, and flight-flutter tests. F.O.S.

N75-28020 Air Force Flight Dynamics Lab., Wright-Patterson AFB, Ohio.
RECENT ANALYSIS METHODS FOR WING-STORE FLUTTER
Walter J. Mykytow *In* AGARD Specialists Meeting on Wing-With-Stores Flutter Apr. 1975 15 p refs (For availability see N75-28011 19-02)

A summary of a brief review for some of the literature on the practical aspects of wing-store flutter prediction and prevention. Brief comments are given on the advantages and disadvantages of various aspects of analytical and test procedures. Descriptions of improved analytical procedures developed for the United States Air Force is then given. Two methods are described in some detail and the results of the investigators are outlined. One is a rapid special purpose wing-store flutter analysis program called FACES. It has data storage and retrieval capabilities which together with a diagnostic and interpolation/extrapolation procedure estimate the flutter speed of new, similar stores. The system can be coupled to a cathode ray tube to increase man/machine interaction and reduce decision times. The other analysis method described is based on the perturbation approach. Computation times can be reduced 90% by using the previously available data. The method produces good results when the mass or stiffness changes are small so that in turn, eigenvalue and eigenvector changes are small. A graph of flutter speed versus important parameters can be produced in one minute on a modern computer. Author

N75-28021*# Old Dominion Univ. Research Foundation, Norfolk, Va. School of Engineering.
ANALYTICAL SIMULATION OF THE FAR-FIELD JET NOISE AND THE UNSTEADY JET FLOW-FIELD BY A MODEL OF PERIODIC SHEDDING OF VORTEX RING FROM THE JET EXIT Final Technical Report
Chen-Huei Liu Aug. 1975 4 p
(Grant NsG-1144)
(NASA-CR-143211; TR-75-T10) Avail: NTIS HC $3.25 CSCL 01A

The construction of a theoretical flow field due to shedding of vortex rings, the identification of the controlling parameters, and the determination of whether the theoretical model successfully simulated the unsteady pressure field near jet (and consequently the far field noise) was studied. The basic parameters contained in the analytic solutions were the epoch at which a vortex ring was shed near the jet exit and the eddy viscosity coefficient. These parameters were identified from the experimental data for the real-time pressure and from the spread of the mixing layer of the jet. Results of the theoretical analysis show good qualitative agreement with the experimental data. Author

N75-28022# McGill Univ., Montreal (Quebec). Mechanical Engineering Research Labs.
REYNOLDS STRESS AND VELOCITY MEASUREMENTS IN A TURBULENT TRAILING VORTEX
J. A. H. Graham and W. R. Phillips Apr. 1975 49 p refs (TN-75-1) Avail: NTIS HC $3.75

The results of a series of experiments conducted in a circular blower wind tunnel on a turbulent trailing vortex of Reynolds number Gamma sub infinity/nu = 57000 are given. The results include the rotational and axial velocity components and the complete Reynolds stress tensor, for five cases of axial momentum, two jets, two wakes and a case of zero momentum increment. All measurements were made with a hot wire anemometer linked to an on-line digital computer. Results are given at three downstream locations, x/c = 45, 78 and 109 where c is the average chord width of the vortex generator. Author

N75-28023# National Physical Lab., Teddington (England). Div. of Maritime Science.
PRACTICAL SOLUTIONS TO SOME WIND-INDUCED VIBRATION PROBLEMS
R. E. Whitbread May 1975 20 p refs Presented at Proc. of Intern. Symp. on Vibration Probl. in Ind., Keswick, Engl., 10-12 Apr. 1973 Submitted for publication
(NPL-Mar-Sci-R124) Avail: NTIS HC $3.25

Wind-induced instability of structures due to vortex shedding is considered. Examples of structures where oscillation has occurred are presented the practical measures taken to overcome the problem described. A general approach is provided to the prediction of aerodynamic instability and to methods of avoiding troublesome oscillation. Values of Strouhal frequency are given for a range of structural shapes thus enabling the corresponding critical wind speeds for the onset of instability to be calculated. In the case of the square and circular sections further data are given on the limiting values of a damping parameter for stability. Logarithmic decrement values for different types of construction are also suggested. Author

N75-28024*# Georgia Inst. of Tech., Atlanta.
OPTIMUM PERFORMANCE AND POTENTIAL FLOW FIELD OF HOVERING ROTORS Final Report
J. C. Wu and R. K. Sigman May 1975 95 p refs Sponsored in part by Army Air Mobility R and D Lab., Moffett Field, Calif.
(Contract NAS2-6340)
(NASA-CR-137705) Avail: NTIS HC $4.75 CSCL 01A

Rotor and propeller performance and induced potential flowfields were studied on the basis of a rotating actuator disk concept, with special emphasis on rotors hovering out of ground effect. A new theory for the optimum performance of rotors hovering OGE is developed and presented. An extended theory for the optimum performance of rotors and propellers in axial motion is also presented. Numerical results are presented for the optimum distributions of blade-bound circulation together with axial inflow and ultimate wake velocities for the hovering rotor over the range of thrust coefficient of interest in rotorcraft applications. Shapes of the stream tubes and of the velocities in the slipstream are obtained, using available methods, for optimum and off-optimum circulation distributions for rotors hovering in and out of ground effect. A number of explicit formulae useful in computing rotor and propeller induced flows are presented for stream functions and velocities due to distributions of circular vortices over axi-symmetric surfaces. Author

N75-28025*# Virginia Univ., Charlottesville. Dept. of Engineering Science and Systems.
DEVELOPMENT OF SUPERCONDUCTOR MAGNETIC SUSPENSION AND BALANCE PROTOTYPE FACILITY FOR

STUDYING THE FEASIBILITY OF APPLYING THIS TECHNIQUE TO LARGE SCALE AERODYNAMIC TESTING Final Report, 1 Sep. 1969 - 30 Sep. 1974
R. N. Zapata, R. R. Humphris, and K. C. Henderson Washington NASA Jul. 1975 64 p refs
(Grant NGR-47-005-112)
(NASA-CR-2565) Avail: NTIS HC $4.25 CSCL 01A

The unique design and operational characteristics of a prototype magnetic suspension and balance facility which utilizes superconductor technology are described and discussed from the point of view of scalability to large sizes. The successful experimental demonstration of the feasibility of this new magnetic suspension concept of the University of Virginia, together with the success of the cryogenic wind-tunnel concept developed at Langley Research Center, appear to have finally opened the way to clean-tunnel, high-Re aerodynamic testing. Results of calculations corresponding to a two-step design extrapolation from the observed performance of the prototype magnetic suspension system to a system compatible with the projected cryogenic transonic research tunnel are presented to give an order-of-magnitude estimate of expected performance characteristics. Research areas where progress should lead to improved design and performance of large facilities are discussed. Author

N75-28026*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED UPWASH INTERFERENCE ON A TRANSPORT MODEL IN A RECTANGULAR SLOTTED-WALL WIND TUNNEL
Michael J. Mann Washington Aug. 1975 25 p refs
(NASA-TM-X-3218; L-10042) Avail: NTIS HC $3.25 CSCL 01A

A study was made of the upwash interference caused by the wind tunnel walls at a Mach number of 0.20. The wind tunnel has slotted horizontal walls and solid vertical walls and the wind tunnel model is a wing-fuselage combination typical of a short take-off and landing (STOL) transport. Measurements were made of the model forces and angle of attack. The experimental results are compared to theoretical solutions for the upwash interference. This comparison enabled an indirect determination of one of the constants in the slotted wall boundary condition. The magnitude of the experimental upwash interference is also compared to the accuracy of the data. This comparison indicates that it is difficult to make definite conclusions based on the experimental data. Suggestions are made for future research which could provide a practical means of accurately determining the wall-interference velocities in wind tunnels with rigid slotted walls. Author

N75-28027*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECT OF VERTICAL-TAIL LOCATION ON THE AERODYNAMIC CHARACTERISTICS AT SUBSONIC SPEEDS OF A CLOSE-COUPLED CANARD CONFIGURATION
Jarrett K. Huffman Washington Aug. 1975 49 p refs
(NASA-TN-D-7947; L-9961) Avail: NTIS HC $3.75 CSCL 01A

The effects were studied of various vertical-tail configurations on the longitudinal and lateral directional-stability characteristics of a general research fighter model utilizing wing-body-canard. The study indicates that the addition of the high canard resulted in an increase in total lift at angles of attack above 4 deg with a maximum lift coefficient about twice as large as that for the wing-body configuration. For the wing-body (canard off) configuration, the center-line vertical tail indicates positive vertical-tail effectiveness throughout the test angle-of-attack range; however, for this configuration none of the wing-mounted vertical-tail locations tested resulted in a positive directional-stability increment at the higher angles of attack. For the wing-body-canard configuration several outboard locations of the wing-mounted vertical tails were found. Author

N75-28028*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SONIC BOOM PRESSURE SIGNATURES FOR THE SPACE SHUTTLE LAUNCH VEHICLE
Joel P. Mendoza May 1975 73 p refs
(NASA-TM-X-62441; A-6092) Avail: NTIS HC $4.25 CSCL 01B

Sonic boom pressure signatures were measured in supersonic and hypersonic wind tunnels for models of the space shuttle launch vehicle at 0 deg angle of attack with and without solid body simulations of the exhaust plumes. Data were measured at 30 deg increments in roll angle from 90 deg to 180 deg at Mach numbers from 3.02 to 5.56. Author

N75-28029*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE DISTRIBUTIONS ON A CAMBERED WING BODY CONFIGURATION AT SUBSONIC MACH NUMBERS
William P. Henderson Washington Jul. 1975 151 p refs
(NASA-TN-D-7946; L-10105) Avail: NTIS HC $6.25 CSCL 01A

An investigation was conducted in the Langley high-speed 7- by 10-foot tunnel at Mach numbers of 0.20 and 0.40 and angles of attack up to about 22 deg to measure the pressure distributions on two cambered-wing configurations. The wings had the same planform (aspect ratio of 2.5 and a leading-edge-sweep angle of 44 deg) but differed in amounts of camber and twist (wing design lift coefficient of 0.35 and 0.70). The effects of wing strake on the wing pressure distributions were also studied. The results indicate that the experimental chordwise pressure distribution agrees reasonably well with the design distribution over the forward 60 percent of nearly all the airfoil sections for the lower cambered wing. The measured lifting pressures are slightly less than the design pressures over the aft part of the airfoil. For the highly cambered wing, there is a significant difference between the experimental and the design pressure level. The experimental distribution, however, is still very similar to the prescribed distribution. At angles of attack above 12 deg, the addition of a wing-fuselage strake results in a significant increase in lifting pressure coefficient at all wing stations outboard of the strake-wing intersection. Author

N75-28030*# Lockheed-Georgia Co., Marietta.
CALCULATION OF UNSTEADY TRANSONIC AERODYNAMICS FOR OSCILLATING WINGS WITH THICKNESS
S. Y. Ruo and J. G. Theisen Washington NASA Aug. 1975 53 p refs
(Contract NAS1-11156)
(NASA-CR-2259; LG74ER0129) Avail: NTIS HC $4.25 CSCL 01A

An analytical approach is presented to account for some of the nonlinear characteristics of the transonic flow equation for finite thickness wings undergoing harmonic oscillation at sonic flight speed in an inviscid, shock-free fluid. The thickness effect is accounted for in the analysis through use of the steady local Mach number distribution over the wing at its mean position by employing the local linearization concept and a coordinate transformation. Computed results are compared with that of the linearized theory and experiments. Based on the local linearization concept, an alternate formulation avoiding the limitations of the coordinate transformation method is presented. Author

N75-28031# Aeronautical Research Council, London (England).
ON THE APPLICATION OF SUBSONIC LINEARISED WING THEORY TO SECOND-ORDER FORCES AND MOMENTS
1975 67 p refs Supersedes ARC-34689; RAE-TR-73030; ARC-34-707
(ARC-R/M-3758; ARC-34689; RAE-TR-7303; ARC-34707) Avail: NTIS HC $4.25; HMSO £3.50; PHI $13.45

Approaches to the evaluation of the second order aerodynamic side force and yawing moment on lifting wings are given in terms of the role of leading edge and side edge forces. For individual titles, see N75-28032 through N75-28033.

N75-28032 Queen Mary Coll., London (England).
GENERAL PRINCIPLES AND MATHEMATICAL MODELS
G. J. Hancock *In* Aeron. Res. Council On the Appl. of Subsonic Linearised Wing Theory to Second-Order Forces and Moments 1975 p 5-32 refs (For availability see N75-28031 19-02)
Copyright.

The mathematical formulation of linearized finite wing theory in low speed steady flow is introduced and discussed. The lifting surface model, in which the vorticity is placed on a planar surface,

is shown to lead to inconsistent results. Consistent results are obtained when the vorticity is placed on the camber surface analysis involving the Trefftz plane, the side force and yawing moment are derived from approximate expressions which avoid calculation of any edge forces. Author (ESRO)

N75-28033 Royal Aircraft Establishment, Farnborough (England).
EDGE FORCES AND ROLL-RATE DERIVATIVES
H. C. Garner *In* Aeron. Res. Council On the Appl. of Subsonic Linearised Wing Theory to Second-Order Forces and Moments 1975 p 33-65 refs (For availability see N75-28031 19-02)
Copyright.

The analysis of linearized subsonic lifting surface theory is extended to provide expressions for the leading edge and side edge forces. The side force and yawing moment under conditions of asymmetric spanwise loading are obtained as the sum of three contributions: normal pressures, leading edge suction, and tip suction. These quantities are used to treat lifting wings in roll. General trends in the theoretical derivatives are observed. The related evidence from experiment and from semi-empirical methods is discussed, and one such method is transcribed for use in conjunction with the theoretical computations. Much of the nonlinear experimental behavior of the side force and yawing moment due to rate of roll can be accounted for by the removal of an increasing proportion of the theoretical edge forces as the lift increases. Author (ESRO)

N75-28034# Manchester Univ. (England). Dept. of Mechanical Engineering.
THE EFFECT OF DAMPING FACTOR ON THE BEHAVIOUR OF FLOW CALCULATIONS IN TURBOMACHINES
C. Bosman London Aeron. Res. Council 1975 35 p refs Supersedes ARC-35099
(ARC-R/M-3766; ARC-35099) Avail: NTIS HC $3.75; HMSO £1.98; PHI $7.65

The damping factor mechanism is discussed, including convergence behavior and solution extrapolation. Meridional flow calculations and blade-to-blade flow calculations are also included. For individual titles, see N75-28035 through N75-28037.

N75-28035 Manchester Univ. (England).
THE MECHANISM OF DAMPING FACTOR
C. Bosman and M. J. Hill *In its* The Effect of Damping Factor on the Behaviour of Flow Calculations in Turbomachines 1975 p 3-13 (For availability see N75-28034 19-02)
Copyright.

The dependence is discussed for asymptotic numerical convergence upon the eigenvalues of a perturbation matrix which is a function of the principal equation of motion for the calculation of two dimensional flows in turbomachines. The mechanism of damping and its limitations are thereby exposed and presented graphically. The interpretation of convergence criterion is discussed, and proposals made to improve the numerical solution by extrapolation. Author (ESRO)

N75-28036 Manchester Univ. (England).
MERIDIONAL FLOW CALCULATIONS
In its The Effect of Damping Factor on the Behaviour of Flow Calculations in Turbomachines 1975 p 14-22 (For availability see N75-28034 19-02)
Copyright.

The convergence of solutions for prescribed S2 surface flows and axisymmetric flows is discussed. It is shown that these are strongly influenced by the density stream function relationship, leading to a Mach number limitation but being also dependent upon the stream surface twist. The principles of the damping factor mechanism and theory of meridional flow calculations are illustrated by numerical examples. Author (ESRO)

N75-28037 Manchester Univ. (England).
BLADE-TO-BLADE FLOW CALCULATIONS
C. Bosman, R. B. Deshpande, and M. J. Hill *In its* The Effect of Damping Factor on the Behaviour of Flow Calculations in Turbomachines 1975 p 23-29 (For availability see N75-28034 19-02)
Copyright.

The principles of the damping factor mechanism was illustrated and applied to prescribed S1 stream surfaces of revolution. It is demonstrated that a density-stream function relationship similar to that of meridional flow controls convergence behavior of these flows, but that lack of stream surface twist conveys superior properties which are only Mach number limited. In all cases, the Mach number limitation coincides with the elliptic-hyperbolic boundary of the analytic problem.
Author (ESRO)

N75-28038# Army Foreign Science and Technology Center, Charlottesville, Va.
VORTEX WAKE BEHIND A HELICOPTER
A. Larin 16 Jun. 1974 10 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), v. 3, 1973 p 32-33
(AD-A005479; FSTC-HT-23-0317-74) Avail: NTIS CSCL 01/3

Research into the vortex wake behind a helicopter was recently carried out. It was found that vortex chords and cores created behind a helicopter are complex structures and are quite stable. The phenomenon of secondary vortex generation was studied on a model with various numbers of blades. GRA

N75-28039# Aerospace Corp., El Segundo, Calif.
TRAJECTORY RECONSTRUCTION PROGRAM (TRP). MILESTONE 7 REPORT: USAGE GUIDE
M. J. Rademacher 15 Nov. 1974 700 p refs
(Contract F04701-74-C-0075)
(AD-A005309; TR-0075(9320)-4; SAMSO-TR-75-15) Avail: NTIS CSCL 16/2

The Trajectory Reconstruction Program (TRP) system consists of vehicle simulation subprograms designed and written in FORTRAN for CDC 6600/7600, IBM 360/370, and UNIVAC 1108/1110 series computers. The overall simulation system has been designed to accommodate extreme variations in vehicle configuration, flight profile, and mission objective and to provide a fast reaction to specific simulations at minimal cost. This simulation system consists of a family of computer subprograms from which a judicious selection can be made to form a specific simulation system for a particular simulation task. GRA

N75-28040# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Aeroballistics Directorate.
THE AERODYNAMIC CHARACTERISTICS OF WRAP-AROUND FINS, INCLUDING FOLD ANGLE AT MACH NUMBERS FROM 0.5 TO 3.0
C. Wayne Dahlke and Lewis D. Flowers 15 Nov. 1974 367 p
(DA Proj. 1M2-62303-A-214)
(AD-A005574; RD-75-15) Avail: NTIS CSCL 16/4

An experimental investigation was conducted in the McDonnell Douglas Aerophysics Laboratory 4-foot trisonic wind tunnel to study the aerodynamic characteristics of wrap around fins. Wrap around fins with leading edge sweep angle and exposed semi-span variations were tested. One unswept fin was tested simulating various opening angles from 10 degrees beyond fully open to a folding angle of 112.5 degrees. Force and moment data were obtained at Mach Numbers from 0.5 to 3.0 at angles of attack up to 14 degrees and roll angles from 0 to 45 degrees. The complete results of this test are presented in plotted form for the main balance and all four fin balances. GRA

N75-28041# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Aerospace and Ocean Engineering.
ANALYTIC INVESTIGATION OF TRANSONIC NORMAL SHOCK BOUNDARY LAYER INTERACTION
W. H. Mason and G. R. Inger 1974 275 p refs
(Contract N00014-72-A-0136-0001; NR Proj. 061-197)
(AD-A004980; VPI-Aero-027) Avail: NTIS CSCL 01/1

Advances in inviscid transonic flow field computational capability and supercritical airfoil design make it important to understand the physics of normal shock-boundary layer interactions. In this work, the Navier-Stokes equations are thoroughly investigated through the use of perturbation methods and a generalized multi-region model is proposed for interactions between weak normal shock waves and turbulent boundary layers. This model is first applied to a highly idealized case in which a uniform subsonic flow is used to model the boundary layer, and

analytic results for the wall and interface pressure are obtained. GRA

N75-28042# Chrysler Corp., New Orleans, La. Data Management Services.
TRANSONIC WIND TUNNEL INVESTIGATION OF THRUST EFFECTS ON THE LONGITUDINAL STABILITY CHARACTERISTICS OF SEVERAL BODY-FIN CONFIGURATIONS (STING-MOUNTED MODEL WITH NORMAL-JET PLUME SIMULATOR)
J. H. Henderson 31 Dec. 1974 438 p refs
(Contract DAAH03-74-C-0405; DA Proj. 1M2-62303-A-214)
(AD-A005152; DMS-AR-1021; RD-75-14) Avail: NTIS CSCL 19/7

Transonic wind tunnel tests were conducted on a sting-mounted model to determine thrust effects on longitudinal stability characteristics of several body-fin combinations. The plume was simulated by cold air ejected from a series of sonic jets normal to the missile axis. One fin configuration was tested at several longitudinal positions. Adverse plume effects on stability were reduced by location of fins a distance forward of the base. The test was conducted at the Calspan Corporations: 8 foot Transonic Wind Tunnel at Mach numbers ranging from 0.4 to 1.25. Angles of attack ranged from -4 degrees to 12 degrees. Data were also obtained at roll angles of 22.5 degrees and 45 degrees for one configuration. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation*.

N75-28043*# United Aircraft Corp., Stratford, Conn. Sikorsky Aircraft Div.
CONCEPTUAL DESIGN STUDY OF 1985 COMMERCIAL VTOL TRANSPORTS THAT UTILIZE ROTORS
N. F. K. Kefford and C. L. Munch Washington NASA May 1975 130 p refs
(Contract NAS2-8079)
(NASA-CR-2532; SER-50891) Avail: NTIS HC $5.75 CSCL 01C

Conceptual design studies of pure and compound helicopter commercial short-haul transport aircraft for initial fabrication in 1980 were performed to determine their technical and economic feasibility. One-hundred-passenger configurations were optimized for minimum direct operating cost consistent with producibility and marketability, with emphasis on proper account of mass properties, performance and handling qualities adequacy, and suppression of internal and external noise. The effect of external noise constraints was assessed, in terms of gross weight and direct operating cost, for each aircraft. Author

N75-28044*# Boeing Vertol Co., Philadelphia, Pa.
CONCEPTUAL ENGINEERING DESIGN STUDIES OF 1985-ERA COMMERCIAL VTOL AND STOL TRANSPORTS THAT UTILIZE ROTORS Final Report
J. P. Magee, R. D. Clark, and C. A. Widdison Washington NASA May 1975 123 p refs
(Contract NAS2-8048)
(NASA-CR-2545; D210-10918-1) Avail: NTIS HC $5.25 CSCL 01C

Conceptual design studies are summarized of tandem-rotor helicopter and tilt-rotor aircraft for a short haul transport mission in the 1985 time frame. Vertical takeoff designs of both configurations are discussed, and the impact of external noise criteria on the vehicle designs, performance, and costs are shown. A STOL design for the tilt-rotor configuration is reported, and the effect of removing the vertical takeoff design constraints on the design parameters, fuel economy, and operating cost is discussed. Author

N75-28045*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
OPERATIONAL EXPERIENCES OF A COMMERCIAL HELICOPTER FLOWN IN A LARGE METROPOLITAN AREA
Daniel J. DiCarlo Washington Aug. 1975 18 p refs
(NASA-TN-D-8000; L-10149) Avail: NTIS HC $3.25 CSCL 01C

A survey of commercial helicopter-operating experiences was conducted using a helicopter flight recorder in order to provide a basis for extending helicopter design and service-life criteria. These data are representative of 182 flight hours accumulated during 1414 flights comprised of the separate legs of the total route structure employed. The operating experiences are presented in terms of the time spent within different airspeed brackets, within the classifiable flight conditions of climb, en route, and descent, at various rates of climb and descent, and at different rotor rotational speeds. The results indicated that the helicopter spent a majority of the flight time at airspeeds either below 40 knots or above 100 knots. Rates of climb and descent were concentrated at values below 5.1 m/s (1000 ft/min) particularly for higher airspeeds. Normal acceleration experiences were low, both in the total number and peak value realized; however, an extremely large number of pitch angular-velocity experiences were noted. Rotor rotational speeds were normal with no occurrences above the upper red-line limit. Author

N75-28046# Air Force Global Weather Central, Offutt AFB, Nebraska.
COMPUTER FLIGHT PLAN SYSTEM
Charles Cook 1 Jan. 1974 65 p refs
(AD-A005496; AFGWC-TM-74-2) Avail: NTIS CSCL 01/2

Computer flight planning support for Department of Defense activities is provided by the Air Force Global Weather Central (AFGWC). Computer flight plans are generated from user specifications of flight path and aircraft characteristics. Route selection is made by the requester after evaluating both meteorological and non-meteorological variables affecting his planned flight. Route specifications may be supplied at the time of the request or obtained from a library of pre-defined routes maintained at AFGWC. The flight plan system consists of two major components. The Operational Flight Data component accomplishes the Collection, management and accounting of all data necessary to specify the route. The Flight Simulation Model component simulates the flight of an aircraft through the AFGWC's data base. GRA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Spacecraft Communications, Command, and Tracking* and *32 Communications*.

N75-28047# Facility Checking Squadron (1866th) (AFCS), Richards-Gebaur AFB, Mo.
COMMUNICATIONS STATION EVALUATION REPORT: EGLIN AFB, FLORIDA
Bruce E. Wallachy 30 Oct. 1974 101 p
(AD-A005292; Rept-74/66C/24) Avail: NTIS CSCL 17/7

The purpose of the evaluation was to define the capabilities and limitations of the Air Traffic Control VHF/UHF communication system both in coverage and performance. Included in this report are evaluation procedures, results and analysis of equipment checks, a loop test line level diagram, weather data, line of sight coverage data, and results and analysis of the airborne flight tests. The data presented in this report can be used as a guide for anticipated performance of the system until an addition, deletion, or relocation of equipment which affects the system occurs. GRA

N75-28048# Computer Sciences Corp., Falls Church, Va.
PROCEEDINGS OF THE LORAN-C WORKSHOP
Gabriel Frankel 1974 221 p refs Conference held at Gettysburg, Pa., 5-7 Jun. 1974
(Contract DOT-CG-42938-A)
(AD-A005709) Avail: NTIS CSCL 17/7

The workshop objectives were to provide a means for the professional community of radio navigation users, and those providing technical support, to participate in defining problems and recommending solutions related to the implementation of LORAN-C. GRA

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics*.

N75-28049*# Lockheed-Georgia Co., Marietta.
APPLICATION OF ACTIVE CONTROLS TECHNOLOGY TO THE NASA JET STAR AIRPLANE Final Report
R. H. Lange, J. F. Cahill, M. C. Campion, E. S. Bradley, D. G. MacWilkinson, and J. W. Phillips Washington NASA Jun. 1975 206 p refs
(Contract NAS4-2121)
(NASA-CR-2561; H-868) Avail: NTIS HC $7.25 CSCL 01C

The feasibility was studied of modifying a Jet Star airplane into a demonstrator of benefits to be achieved from incorporating active control concepts in the preliminary design of transport type aircraft. Substantial benefits are shown in terms of fuel economy and community noise by virtue of reduction in induced drag through use of a high aspect ratio wing which is made possible by a gust alleviation system. An intermediate configuration was defined which helps to isolate the benefits produced by active controls technology from those due to other configuration variables. Also, an alternate configuration which incorporated composite structures, but not active controls technology, was defined in order to compare the benefits of composite structures with those of active controls technology. Author

N75-28050*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
THE INFLUENCE OF ENGINE/TRANSMISSION/GOVERNOR ON TILTING PROPROTOR AIRCRAFT DYNAMICS
Wayne Johnson Jun. 1975 27 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Moffett Field, Calif.
(NASA-TM-X-62455) Avail: NTIS HC $3.75 CSCL 01C

An analytical model is developed for the dynamics of a tilting proprotor aircraft engine and drive train, including a rotor speed governor and interconnect shaft. The dynamic stability of a proprotor and cantilever wing is calculated, including the engine-transmission-governor model. It is concluded that the rotor behaves much as if windmilling as far as its dynamic behavior is concerned, with some influence of the turboshaft engine inertia and damping. The interconnect shaft has a significant influence on the antisymmetric dynamics of proprotor aircraft. The proprotor aerodynamics model is extended to include reverse flow, and a refinement on the method used to calculate the kinematic pitch-bending coupling of the blade is developed. Author

N75-28051# General Dynamics/Convair, San Diego, Calif. Aerospace Div.
WEAPON SYSTEM COSTING METHODOLOGY FOR AIRCRAFT AIRFRAMES AND BASIC STRUCTURES. VOLUME 2: SUPPORTING DESIGN SYNTHESIS PROGRAMS Technical Report, Jul. 1972 - Dec. 1973
R. E. Kenyon Sep. 1974 73 p refs
(AF Proj. 1368)
(AD-A005426; AFFDL-TR-73-129-Vol-2) Avail: NTIS CSCL 01/3

This volume describes the supporting programs used in conjunction with a cost estimating program to provide a trade study cost estimating technique for aerodynamic surfaces. The supporting programs for the purpose of this discussion are defined as a structural synthesis program and a secondary structure synthesis program. The structural synthesis program is used for the analysis of primary structure and is called APAS (Automated Program for Aerospace-Vehicle Synthesis). The secondary structure synthesis program estimates geometry and weights, and performs parts definition for the aerodynamic surface leading edge, trailing edge, and tip components. The cost estimating adaptation is derived from programs originally developed under Independent research and development. GRA

N75-28052# Northrop Corp., Hawthorne, Calif. Aircraft Div.
FLIGHT SIMULATION OF THE MODEL 347 ADVANCED TANDEM-ROTOR HELICOPTER Final Report, Jul. 1972 - Oct. 1973
Don F. Kesler, Allen Y. Murakoshi, and John B. Sinacori Nov. 1974 66 p
(Contract DAAJ02-72-C-0112; DA Proj. 1F1-63204-D-157)
(AD-A005050; NOR-73-190; USAAMRDL-TR-74-21) Avail: NTIS CSCL 01/3

The basic purpose of the study was to define important flight control system design and handling qualities criteria for moving loads along beneath tandem-rotor heavy lift helicopters. The principal study effort involved flight simulation of the Model 347 advanced tandem-rotor helicopter. Methodologies used in developing data included theoretical analyses, acquisition and evaluation of wind tunnel and flight test data, derivation of motion equations, analysis of sling load carrying problems, development of the dynamics of a container slung beneath a tandem-rotor helicopter, and the actual flight simulation of a Model 347 helicopter with external loads using Northrop's advanced large-amplitude moving-base simulator and its associated hybrid computers. GRA

N75-28053# Honeywell, Inc., Minneapolis, Minn. Systems and Research Center.
APPLICATION OF STEEP ANGLE APPROACH IN AN ENGINEERING AND FLIGHT TEST PROGRAM Final Report, Jun. 1972 - Sep. 1974
James W. Wingert Oct. 1974 120 p
(Contract N00014-72-C-0498; NR Proj. 213-109)
(AD-A005074; JANAIR-741002) Avail: NTIS CSCL 01/2

This study is part of the Army program whose overall objectives are to determine the adequacy of the MLS guidance signals required for integration with state-of-the-art displays to enable safe, controlled, decelerating steep angle approaches and landings to be made by helicopters and to provide display hardware suitable for integration with the MLS Army prototype evaluation. The objective of this particular study is to apply the results of the previous JANAIR Steep Angle Approach and Landing study tasks, which have been analytic and simulation efforts, to a flight test of concepts, principles and mechanization. GRA

N75-28054# Boeing Vertol Co., Philadelphia, Pa.
CRASHWORTHY HELICOPTER GUNNER'S SEAT INVESTIGATION Final Report
Mason J. Reilly Jan. 1975 255 p refs
(Contract DAAJ02-73-C-0021; DA Proj. 1F2-62209-AH-76)
(AD-A005563; D210-10840-1; USAAMRDL-TR-74-98) Avail: NTIS CSCL 01/3

The poor crash-impact performance of seats designed to current military specifications was revealed by the U.S. Army in the early 1960's. It was discovered that numerous seat occupants were being injured during moderate impacts because of inadequate upper torso restraint, inadequate seat strength, absence of any meaningful vertical crash-force attenuation, and inadequate testing criteria. Following extensive design and testing efforts, improved crashworthiness design and testing criteria were developed for Army aircraft seating systems. GRA

N75-28055# Kaman Aerospace Corp., Bloomfield, Conn.
FAN-IN-FUSELAGE ADVANCED ANTITORQUE SYSTEM Final Report, 9 Feb. 1973 - 31 Jan. 1974
Carroll R. Akeley and George W. Carson Nov. 1974 101 p refs
(Contract DAAJ02-73-C-0033; DA Proj. 1F1-62204-AA-44)
(AD-A005049; USAAMRDL-TR-74-89) Avail: NTIS CSCL 01/3

The information contained in this report is a result of study, analysis and design conducted to determine the performance of a helicopter with a fan-in-fuselage antitorque and yaw control system, as compared with the performance of the same basic helicopter with a tail rotor. GRA

N75-28056# General Dynamics/Fort Worth, Tex.
PROPOSED MIL-STD-XXX AIRCRAFT NONNUCLEAR SURVIVABILITY/VULNERABILITY TERMS
Dec. 1974 177 p Sponsored in part by Navy
(Contract F33615-73-C-3150)
(AD-A004972; JTCG/AS-74-D-002) Avail: NTIS CSCL 01/3

This document established standard definitions for aircraft non-nuclear S/V (survivability/vulnerability) terms so communication problems that have confronted S/V practitioners and workers in allied disciplines, in government agencies and industry, can be resolved. The terms and definitions contained herein shall be used, as applicable, in all Department of Defense studies, reports, statements-of-work, and other documentation involving nonnuclear aircraft S/V. GRA

N75-28057# Army Aviation Systems Command, St. Louis, Mo.
MAJOR ITEM SPECIAL STUDY (MISS), UH-1H MAIN ROTOR HUB ASSEMBLY Interim Report, Jan. 1964 - Dec. 1973
Jan. 1975 21 p
(AD-A005217; USAAVSCOM-TR-74-54) Avail: NTIS CSCL 01/3

Major Item Special Study (MISS) reports are performed on DA Form 2410 reportable components. These are time change items and certain condition change items selected because of high cost or need for intensive management. Basically, the MISS reports are concerned with analyzing reported removal data presented in the Major Item Removal Frequency (MIRF) report. The failure modes reported for each removal are examined and grouped into categories which are intended to clarify the intent of the data reporting. From this data, removal distribution can be plotted and an MTR (mean time to removal) can be calculated. The MISS reports then investigate possible cost savings based on total elimination of selected failure modes. These modes are chosen because of the percentage of failures they represent and/or because they appear to be feasible Product Improvement Program (PIP) areas. GRA

N75-28058# Army Aviation Engineering Flight Activity, Edwards AFB, Calif.
ARMY PRELIMINARY EVALUATION 1: RV-1D/QUICK LOOK 2 AIRCRAFT Final report
Gary L. Bender and James C. OConnor Aug. 1974 26 p refs
(AD-A005220; USAAEFA-74-36) Avail: NTIS CSCL 01/3

The United States Army Aviation Engineering Flight Activity conducted a limited handling qualities evaluation of the RV-1D/Quick Look II aircraft, manufactured by Grumman Aerospace Corporation. The aircraft was tested at the Grumman facility in Stuart, Florida, on 16 and 17 July 1974. Testing included stability and control and miscellaneous engineering tests necessary to verify the flight envelope. No deficiencies were found during these tests. Two shortcomings were identified: inadequate stall warning in the power-approach and landing configurations, and the degraded single-engine performance and maneuvering capability caused by the inability to jettison the Quick Look II antenna pods. GRA

N75-28059# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A DESIGN STUDY FOR A REMOTELY PILOTED VEHICLE, AUTOMATIC LANDING SYSTEM M.S. Thesis
Mark P. Hadley Dec. 1974 111 p refs
(AD-A005285; GE/MA/74D-4) Avail: NTIS CSCL 01/3

A method of control design is developed using optimal control theory which results in a simple and practical control system. The basis of this method is the elimination of unnecessary feedback gains which in turn allows most of the Kalman filter elements to be eliminated also. The procedure is developed by designing an automatic control system for a remotely piloted vehicle. The aircraft modeled in the study was the Ryan Compass Cope RPV. This aircraft has a low wing loading making it very susceptible to wind gusts. The problem is limited to the approach phase of landing under moderate to severe turbulence. Both longitudinal and lateral control systems are considered. GRA

N75-28060# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYTICAL INVESTIGATION OF MEDIUM STOL TRANSPORT STRUCTURAL CONCEPTS. VOLUME 1: STUDY RESULTS Final Report, 15 Mar. 1973 - 24 Jun. 1974
R. E. Adkisson and G. V. Deneff Aug. 1974 454 p refs 2 Vol.
(Contract F33615-73-C-3049; AF Proj. 1368)
(AD-A005818; MDC-J6625-Vol-1; AFFDL-TR-74-109-Vol-1) Avail: NTIS CSCL 01/3

Results of a study program to devise and evaluate new structural concepts of lower weight and cost for a medium STOL transport aircraft are presented. The wing box, fuselage shell and empennage stabilizer structure of the projected C-15 production airplane were designated as the study (and baseline) components. Selected concepts are evaluated for structural integrity, weight, manufacturing methods, applicability of NDI methods, production and life cycle costs and aircraft performance payoffs. Structural integrity analyses of both the baseline and new concepts are based on a common set of requirements for ultimate strength, fatigue life, damage tolerance and flutter rigidity. GRA

N75-28061# Douglas Aircraft Co., Inc., Long Beach, Calif.
ANALYTICAL INVESTIGATION OF MEDIUM STOL TRANSPORT STRUCTURAL CONCEPTS. VOLUME 2: ISOGRAD FUSELAGE STUDY Final Report, 15 Mar. 1973 - 24 Jun. 1974
R. E. Adkisson, G. V. Deneff, B. J. Alperin, R. L. Zwart, and M. L. Platte Aug. 1974 118 p refs 2 Vol.
(Contract F33615-73-C-3049; AF Proj. 1368)
(AD-A006157; MDC-J6625-Vol-2; AFFDL-TR-74-109-Vol-2) Avail: NTIS CSCL 01/3

Results of a study program to evaluate application of the isogrid structure concept to a medium STOL transport aircraft are presented. Isogrid is an integrally stiffened panel concept incorporating a triangular arrangement of the stiffening material which has been used successfully on space vehicle structure. The fuselage shell structure of the projected C-15 production airplane is used as the study and baseline component. The isogrid concept is evaluated for structural concepts are based on a common set of requirements for ultimate strength, fatigue, and damage tolerance. Because of generally lower stress levels and a general absence of rivet and bolt holes in basis isogrid structure, fatigue and damage tolerance are of reduced criticality relative to baseline structure. GRA

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography*.

No abstracts in this category.

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and on-board auxiliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels*, and *44 Energy Production and Conversion*.

N75-28062 Syracuse Univ., N.Y.
NOISE ABATEMENT BY THE INTERACTION OF COLD COAXIAL MODEL JETS Ph.D. Thesis

Mahmound Salim Audi 1974 252 p
Avail: Univ. Microfilms Order No. 75-13958

The possibility of attenuation of noise from jets by inducing interaction between coaxial cold streams is assessed. These streams discharge from two or three nozzles of an assembly of three convergent nozzles whose exits are coplanar. The innermost nozzle is circular while the intermediate and the outermost are annular, and all have the same exit area of .1104 sq in. The two interacting jets investigated here discharge from the innermost and the intermediate nozzles, while the three interacting jets discharge from the three nozzles of the assembly. Throughout almost all of the investigation the reservoir pressure of the intermediate jet, was maintained at 30 psig, while the innermost jet reservoir pressure, and the outermost jet reservoir pressure, are varied systematically from 0 to 30 psig increments. The data gathered for this research includes both shadowgraphic records and far field noise surveys. Dissert. Abstr.

N75-28063 British Library Lending Div., Boston Spa (England).
THE LIGHT INDUSTRIAL GAS TURBINE: PAST AND FUTURE
M. A. W. Stratemeier 14 May 1974 24 p Transl. into ENGLISH from a German report
(BLL-CE-Trans-6395-(9022.09)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

Application of the gas turbine engine to the generation of electricity is considered. Industrial operation of the gas turbine is compared to that of the aircraft engine. Technical modifications are described. J.M.S.

N75-28064# Aeronautical Research Labs., Melbourne (Australia).
CONSTANT VOLUME GAS TURBINE: EXPERIMENTS WITH GASEOUS FUEL IN A ROTATING POCKET COMBUSTOR
B. G. Catchpole and A. Runacres Oct. 1974 26 p refs
(ARL/ME-Note-353) Avail: NTIS HC $3.75

A combustor was developed in which combustion takes place in three pockets which move past inlet and exhaust ports to give a scavenging, combustion, and exhaust sequence. During the period of heat release both ports are closed to permit combustion under constant volume conditions. The performance of the combustor was determined by comparing the observed combustion pressure rise with theoretical predictions. Although the performance was better than any obtained from single valved combustors, it still fell short of that required to demonstrate feasibility. As with the earlier combustors, the combustion efficiency was poor. There was some evidence to suggest that a rearrangement of the ports to allocate an increased proportion of the cycle time to combustion would result in significant improvement. Author

N75-28065# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario). Behavioural Sciences Div.
NOISE LEVELS IN THE CC-109, CC-115, AND CC-117 AIRCRAFT
S. E. Forshaw, R. A. Stong, and R. B. Crabtree Sep. 1974 18 p refs
(DCIEM-74-R-1059) Avail: NTIS HC $3.25

The results of noise surveys in the CC-109, CC-115 and CC-117 aircraft, are reported and the effectiveness of current CF headsets in minimizing the risk of noise-induced hearing loss among the crews of these aircraft, was discussed. The H-157/AIC headset provides adequate protection for the crew of the CC-109 aircraft, and for the pilots of the CC-115 aircraft. The navigator of the CC-115, however, is located in an extremely noisy area of the aircraft and requires the added low frequency protection provided by the NX-10 headset. Pilots of the CC-117 aircraft do not require hearing protection and may prefer, therefore, to wear a more comfortable headset such as the Airlite 71. Author

N75-28066*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERIOR NOISE LEVELS OF TWO PROPELLER-DRIVEN LIGHT AIRCRAFT
John J. Catherines and William H. Mayes Jul. 1975 21 p refs
(NASA-TM-X-72716) Avail: NTIS HC $3.25 CSCL 20A

The relationships between aircraft operating conditions and interior noise and the degree to which ground testing can be used in lieu of flight testing for performing interior noise research were studied. The results show that the noise inside light aircraft is strongly influenced by the rotational speed of the engine and propeller. Both the overall noise and low frequency spectra levels were observed to decrease with increasing high speed rpm operations during flight. This phenomenon and its significance is not presently understood. Comparison of spectra obtained in flight with spectra obtained on the ground suggests that identification of frequency components and relative amplitude of propeller and engine noise sources may be evaluated on stationary aircraft. Author

N75-28067*# AiResearch Mfg. Co., Torrance, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: AEROTHERMODYNAMIC INTEGRATION MODEL (AIM) DATA REDUCTION COMPUTER PROGRAM, DATA ITEM NO. 54.16
A. Gaede and W. Platte, ed. 16 May 1975 96 p refs
(Contract NAS1-6666)
(NASA-CR-132656; AiResearch-AP-75-11502) Avail: NTIS HC $4.75 CSCL 21E

The data reduction program used to analyze the performance of the Aerothermodynamic Integration Model is described. Routines to acquire, calibrate, and interpolate the test data, to calculate the axial components of the pressure area integrals and the skin function coefficients, and to report the raw data in engineering units are included along with routines to calculate flow conditions in the wind tunnel, inlet, combustor, and nozzle, and the overall engine performance. Various subroutines were modified and used to obtain species concentrations and transport properties in chemical equilibrium at each of the internal and external engine stations. It is recommended that future test plans include the configuration, calibration, and channel assignment data on a magnetic tape generated at the test site immediately before or after a test, and that the data reduction program be designed to operate in a batch environment. Author

N75-28068*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL-TIME SIMULATION OF F100-PW-100 TURBOFAN ENGINE USING THE HYBRID COMPUTER
John R. Szuch and Kurt Seldner Washington Aug. 1975 80 p refs
(NASA-TM-X-3261; E-8136) Avail: NTIS HC $4.75 CSCL 21E

A real-time hybrid computer simulation of the F100-PW-100 augmented turbofan is presented. The digital portion of the hybrid computer is used to perform the bivariate function generation associated with modeling the performance of the engine's rozating components. The remaining calculations are performed on the analog computer. Steady state simulation data along with sea level, static, transient data are presented to show that the real-time simulation matches baseline digital simulation results over a wide range of power settings and flight conditions. Steady state simulation data are compared with sea level, experimental data to show that the real-time hybrid and baseline digital simulations do adequately predict the performance of the actual engine. FORTRAN listings and analog patching diagrams are provided. Author

N75-28069*# Flow Research, Inc., Kent, Wash.
NUMERICAL SIMULATION OF TURBULENT JET NOISE, PART 1
Ralph W. Metcalfe and Steven A. Orszag [1975] 75 p refs
(Contract NAS1-12870)
(NASA-CR-132693; Rept-53) Avail: NTIS HC $4.25 CSCL 20A

Flow characteristics, such as quadrupole moments are examined in order to study generation of aerodynamic noise. The mean flow quantities are set in accordance with experimental data and the incompressible Navier-Stokes are solved numerically. Isolated downstream sections of a turbulent jet are modelled separately with the mean flow characteristics held constant in time. The flows are allowed to evolve until the fluctuating velocity components reach a statistically steady state. Cross section contour plots of the velocity components and the quadrupole

moments at three different downstream positions are presented. Author

N75-28070*# National Bureau of Standards, Boulder, Colo.
ASRDI OXYGEN TECHNOLOGY SURVEY. VOLUME 8: PRESSURE MEASUREMENT
John M. Arvidson and James A. Brennan Washington NASA 1975 104 p refs
(NASA-SP-3092) Avail: NTIS HC $5.25 CSCL 14B

Pressure transducers and their current uses with gaseous or liquid oxygen are reviewed. All transducer types such as strain gage, capacitance, potentiometric, piezoelectric, etc., are included. Topics covered include: cryogenic pressure measurement; material compatibility with gaseous and liquid oxygen; cleaning procedures; pressure tap connections; transducer types and descriptions; and calibration techniques. Author

N75-28071*# AiResearch Mfg. Co., Torrance, Calif.
HYPERSONIC RESEARCH ENGINE PROJECT. PHASE 2: AEROTHERMODYNAMIC INTEGRATION MODEL DEVELOPMENT, DATA ITEM NO. 55-4-21 Final Technical Data Report, 10 Mar. 1968 - 22 Apr. 1974
L. F. Jilly, ed. 19 May 1975 414 p refs
(Contract NAS1-6666)
(NASA-CR-132654; AiResearch-AP-75-11133) Avail: NTIS HC $10.50 CSCL 21E

The design and development of the Aerothermodynamic Integration Model (AIM) of the Hypersonic Research Engine (HRE) is described. The feasibility of integrating the various analytical and experimental data available for the design of the hypersonic ramjet engine was verified and the operational characteristic and the overall performance of the selected design was determined. The HRE-AIM was designed for operation at speeds of Mach 3 through Mach 8. Author

N75-28072*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF DESIGN FEATURES ON PERFORMANCE OF A DOUBLE-ANNULAR RAM-INDUCTION COMBUSTOR
Donald F. Schultz Washington Aug. 1975 51 p refs
(NASA-TN-D-7878; E-8210) Avail: NTIS HC $4.25 CSCL 21A

An extensive test program was undertaken to determine the effect of many design features such as the size and number of air scoops, and the type of diffuser airflow distribution to use to optimize performance of a double-annular ram-induction combustor of 94 cm outer diameter. Six combustor configurations were tested. It was found that a snouted double annular combustor built with 256 ram-induction air scoops with a combustor open area giving a total pressure loss of 5.0 percent at a diffuser inlet Mach number of 0.25 gave the best overall performance of the configurations tested. Author

N75-28073# Army Foreign Science and Technology Center, Charlottesville, Va.
THE SELECTION OF A METHOD OF DETERMINATION OF FRACTURE TOUGHNESS ON THE BASIS OF EXPERT OPINIONS
G. S. Pisarenko, A. P. Yastrebov, V. P. Naumenko, and I. K. Chernenko 21 Jul. 1974 19 p refs Transl. into ENGLISH from Probl. Prochnosti v Mashinostr. Akad. Nauk SSSR, Inst. Mashinoved. (Moscow), no. 3, 1973 p 18-24
(AD-A004981; FSTC-HT-23-0695-74) Avail: NTIS CSCL 21/5

A method for determining the optimal manner of testing the materials of turbine rotors and discs is described. A rank correlation method of assessing the opinions of experts is used and the contents and statistically analyzed results of the questionnaire employed are discussed. GRA

N75-28074# Air Force Aero Propulsion Lab., Wright-Patterson AFB, Ohio.
DUMP COMBUSTOR PARAMETRIC INVESTIGATION Final Report, Mar. 1973 - Jan. 1974
F. D. Stull, R. R. Craig, and J. T. Hojnacki Nov. 1974 64 p refs
(AF Proj. 3012)
(AD-A005399; AFAPL-TR-74-90) Avail: NTIS CSCL 21/5

A series of scale model coaxial dump combustors from 2 inch to 5 inch D were tested on a thrust stand with JP-4 fuel over a wide range of ramjet test conditions. Baseline conditions were selected to approximate pressure scaling criteria in which chamber pressure times combustor diameter remains constant. JP-4 fuel was injected perpendicular to the airstream from eight plane tube injectors. Fuel/air ratio, chamber pressure and nozzle throat diameter were varied for each size chamber. Lean blow-out limit, combustion efficiency, combustor pressure drop, and combustion instability characteristics were obtained for each test point. GRA

N75-28075# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
AN ANALYTICAL DERIVATION OF GAS TURBINE ENGINE CONTROL PARAMETERS AND THEIR EFFECTS ON COMPRESSOR MATCH POINT
Gary R. Adams Oct. 1974 36 p
(AD-A005685; ASD-TR-36) Avail: NTIS CSCL 21/5

This report correlates basic control parameters as depicted on the control diagram with compression system operating conditions. GRA

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

N75-28076*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF A LARGE AIRCRAFT TO TRANSPORT SPACE SHUTTLE ORBITER OR OTHER EXTERNAL PAYLOADS
John W. Paulson, Jr. Washington Aug. 1975 62 p refs
(NASA-TN-D-7962; L-10065) Avail: NTIS HC $4.25 CSCL 01C

Wind tunnel tests were conducted in the Langley V/STOL tunnel to determine the aerodynamic characteristics of a large transport aircraft designed to carry the space shuttle orbiter or orbiter booster tank. Results indicate that the transport, with or without payloads, is statically stable, the longitudinal static margins being rather excessive. Elevator power is sufficient to trim the transport up to stall except when the orbiter is mounted close to the wing. Maximum lift-drag ratios at wind tunnel Reynolds numbers vary from 12 to 14 depending on model configuration. Tests were conducted at Reynolds numbers from 1.21 x 1 million to 1.49 x 1 million with angle of attack from -2 deg to 20 deg and angle of sideslip from -5 deg to 5 deg. Author

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tube facilities; and engine test blocks.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N75-28077 Missouri Univ., Columbia.
MEASUREMENT OF IMAGE-FORMING CAPABILITY OF A THERMAL NEUTRON RADIOGRAPHIC FACILITY Ph.D. Thesis
Don McKay Alger 1974 205 p
Avail: Univ. Microfilms Order No. 75-15959

Several methods used to specify the image-forming capability of neutron radiographic facilities are described. Justification for selecting the modulation transfer function (MTF) as the best general quantitative measurement is presented along with a mathematical derivation of the functions for radiographic systems. An experimental program was then conducted to determine the MTF for selected sets of radiographic equipment. Perhaps, the

greatest disadvantage of this method is the extensive initial work required to develop the necessary equipment, techniques, and computer program. Of the three methods used to determine the MTF, the edge gradient analysis technique proved to be the best method for the high resolution components of the radiographic system. Dissert. Abstr.

N75-28078*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY STUDY OF THE MINIMUM TEMPERATURES FOR VALID TESTING IN A CRYOGENIC WIND TUNNEL
Robert M. Hall Aug. 1975 125 p refs
(NASA-TM-X-72700) Avail: NTIS HC $5.25 CSCL 14B

The minimum operating temperature which avoids real-gas effects, such as condensation, was determined for M sub infinity = 0.85 flow over a 0.137-meter NACA 0012-64 airfoil mounted in the Langley 1/3-meter transonic cryogenic tunnel. For temperatures within 5 K of reservoir saturation and total pressures from 1.2 to 4.5 atmospheres, the pressure distributions over the airfoil are not altered by real-gas effects. This ability to test at total temperatures below those which avoid saturation over the airfoil allows an increase in Reynolds number capability of at least 17 percent for a constant tunnel total pressure. Similarly, 17 percent less total pressure is required to obtain a given Reynolds number. Author

N75-28079# Technische Universitaet, Munich (West Germany).
CALIBRATION OF ROUGHNESS PARAMETERS FOR MATHEMATICAL MODELS OF RIVERS WITH FLOOD-PLAINS USING DYNAMIC PROGRAMMING Ph.D. Thesis
F. Hartung 1974 184 p refs In GERMAN; ENGLISH summary
(Rept-30) Avail: NTIS HC $7.00

A dynamic programming approach was used to determine the optimum roughness coefficients for calibrating mathematical models of river flow. The reach of a river under consideration was divided into sub-reaches of different lengths. For each of these sub-reaches, optimum vectors of roughness coefficients for the main channel and the flood plains were determined as functions of steady discharges. The objective function of the optimization procedure was defined as the sum of the squares of the deviations between the measured and calculated water surface profiles. Author

N75-28080*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
THE SELF STREAMLINING WIND TUNNEL
Michael J. Goodyer (Southampton Univ.) Aug. 1975 45 p refs
(NASA-TM-X-72699) Avail: NTIS HC $3.75 CSCL 14B

A two dimensional test section in a low speed wind tunnel capable of producing flow conditions free from wall interference is presented. Flexible top and bottom walls, and rigid sidewalls from which models were mounted spanning the tunnel are shown. All walls were unperforated, and the flexible walls were positioned by screw jacks. To eliminate wall interference, the wind tunnel itself supplied the information required in the streamlining process, when run with the model present. Measurements taken at the flexible walls were used by the tunnels computer check wall contours. Suitable adjustments based on streamlining criteria were then suggested by the computer. The streamlining criterion adopted when generating infinite flowfield conditions was a matching of static pressures in the test section at a wall with pressures computed for an imaginary inviscid flowfield passing over the outside of the same wall. Aerodynamic data taken on a cylindrical model operating under high blockage conditions are presented to illustrate the operation of the tunnel in its various modes. Author

N75-28081# Southern Research Inst., Birmingham, Ala.
ANDERSON FILTER SUBSTRATE WEIGHT LOSS
Wallace B. Smith, Kenneth M. Cushing, and George E. Lacey Feb. 1975 31 p refs
(Contract EPA-68-02-0273)
(PB-240720/3; SORI-EAS-74-392; EPA-650/2-75-022) Avail: NTIS HC $3.75 CSCL 14B

Results are given of an investigation, under laboratory conditions, to determine the extent and cause of weight losses first noticed in field situations on Andersen impactor fiberglass substrates. The investigation results indicate that, if performed carefully throughout, sample acquisition results in a weight loss of no more than 0.20 mg per stage. Such a loss is not of major consequence when more than 2-3 mg is collected on a stage; however, it could represent a serious error at less than 2-3 mg. Incomplete drying and careless handling were found to be the major sources of weight loss. GRA

N75-28082# AAI Corp., Baltimore, Md.
DESIGN OF AMRL IMPACT FACILITY SLED, PROPULSION UNIT AND DECELERATOR Final Report
Henry O. Hubich, H. William Schuette, Donald J. Palughi, Arthur C. Powell, and F. James Schroeder Jan. 1975 89 p refs
(Contract F33615-74-C-5139; AF Proj. 7231)
(AD-A005704; AAI-ER-8142; AMRL-TR-74-118) Avail: NTIS CSCL 14/2

The objective of this program was to develop the facility plans, goals, and specifications for an extension to the existing AMRL Impact Test Facility. The test system designed is to be used to conduct biomedical research related to impact and to investigate principles and techniques of impact protection. The conceptual design of three main facility elements was accomplished. The items designed included an air gun accelerator, a sled or carriage to support the test object and a hydraulic buffer type decelerator. The propulsion unit is capable of accelerating the sled carrying 2000 lb of payload to an impact velocity of 125 fps. The decelerator is capable of providing a peak deceleration level of 150 g. Variable pulse shapes are possible and provision is made for achieving multiple peak pulses. The maximum deceleration stroke is 6 ft. GRA

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration*.

N75-28083*# Battelle Columbus Labs., Ohio.
INVESTIGATION OF IMMISCIBLE SYSTEMS AND POTENTIAL APPLICATIONS Final Report
A. J. Markworth, W. Oldfield, J. Duga, and S. H. Gelles Apr. 1975 118 p refs
(Contract NAS8-29748)
(NASA-CR-120667) Avail: NTIS HC $5.25 CSCL 22A

The droplet coalescence kinetics at 0 g and 1 g were considered for two systems which contained liquid droplets in a host liquid. One of these (Al-In) typified a system containing a liquid phase miscibility gap and the order (oil-water) a mixture of two essentially insoluble liquids. A number of coalescence mechanisms potentially prominent at low g in this system were analyzed and explanations are presented for the observed unusual stability of the emulsion. Ground base experiments were conducted on the coalescence of In droplets in and Al-In alloy during cooling through the miscibility gap at different cooling rates. These were in qualitative agreement with the computer simulation. Potential applications for systems with liquid phase miscibility gaps were explored. Possibilities included superconductors, electrical contact materials, superplastic materials, catalysts, magnetic materials, and others. The role of space processing in their production was also analyzed. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbit and launching dynamics.

N75-28084*# Analytical Mechanics Associates, Inc., Westbury, N.Y.
PROGRAM MANUAL FOR HILTOP, A HELIOCENTRIC INTERPLANETARY LOW THRUST TRAJECTORY OPTIMIZATION PROGRAM. PART 1: USER'S GUIDE
F. I. Mann and J. L. Horsewood Dec. 1974 287 p refs
(Contract NAS8-29945)

(NASA-CR-143894; AMA-74-34-Pt-1) Avail: NTIS HC $8.75 CSCL 22A

A performance-analysis computer program, that was developed explicitly to generate optimum electric propulsion trajectory data for missions of interest in the exploration of the solar system is presented. The program was primarily designed to evaluate the performance capabilities of electric propulsion systems, and in the simulation of a wide variety of interplanetary missions. A numerical integration of the two-body, three-dimensional equations of motion and the Euler-Lagrange equations was used in the program. Transversality conditions which permit the rapid generation of converged maximum-payload trajectory data, and the optimization of numerous other performance indices for which no transversality conditions exist are included. The ability to simulate constrained optimum solutions, including trajectories having specified propulsion time and constant thrust cone angle, is also in the program. The program was designed to handle multiple-target missions with various types of encounters, such as rendezvous, stopover, orbital capture, and flyby. Performance requirements for a variety of launch vehicles can be determined. Author

N75-28085*# Analytical Mechanics Associates, Inc., Westbury, N.Y.

PROGRAM MANUAL FOR HILTOP, A HELIOCENTRIC INTERPLANETARY LOW THRUST TRAJECTORY OPTIMIZATION PROGRAM. PART 2: SUBROUTINE DESCRIPTIONS

F. I. Mann and J. L. Horsewood Dec. 1974 860 p refs
(Contract NAS8-29945)
(NASA-CR-143895; AMA-74-34-Pt-2) Avail: NTIS HC $19.25 CSCL 22A

For abstract, see N75-28084.

N75-28086*# Analytical Mechanics Associates, Inc., Westbury, N.Y.

PROGRAM MANUAL FOR ASTOP, AN ARBITRARY SPACE TRAJECTORY OPTIMIZATION PROGRAM

Jerry L. Horsewood Dec. 1974 590 p
(Contract NAS8-29945)
(NASA-CR-120660; Rept-74-33) Avail: NTIS HC $13.25 CSCL 22A

The ASTOP program (an Arbitrary Space Trajectory Optimization Program) designed to generate optimum low-thrust trajectories in an N-body field while satisfying selected hardware and operational constraints is presented. The trajectory is divided into a number of segments or arcs over which the control is held constant. This constant control over each arc is optimized using a parameter optimization scheme based on gradient techniques. A modified Encke formulation of the equations of motion is employed. The program provides a wide range of constraint, end conditions, and performance index options. The basic approach is conducive to future expansion of features such as the incorporation of new constraints and the addition of new end conditions. Author

N75-28087*# Northrop Services, Inc., Huntsville, Ala.

DIGITAL SIMULATION FOR POST-DOCKING RESPONSE

James R. Roberts and Robert S. Todd Dec. 1974 96 p refs
(Contract NAS8-29627)
(NASA-CR-120663; TR-250-1378) Avail: NTIS HC $4.75 CSCL 22A

The digital program, 2BODY, which simulates the translational and rotational motion of two connected rigid bodies and provides both digital and plot output is described. Relative rotation of the bodies at the connection is allowed, thereby providing a model suitable for studying system stability and response during a soft-dock regime. A users manual for the program is given as well as all the details and background pertaining to the equations of motion and mathematical models, integration scheme, and input/output routines. Author

N75-28088*# TRW Systems, Redondo Beach, Calif.

ASTP EXPERIMENT SUPPORT DATA PROCESSING

R. K. Osburn, Edward L. Barnett, Harry L. Moore, John B. Moore, and Jimmie R. Ball 11 Jul. 1975 180 p refs
(Contract NAS9-13834)
(NASA-CR-141915; JSC-09794; JSC-IN-75-FM-49) Avail: NTIS HC $7.00 CSCL 22A

Activities associated with the generation of ASTP experiment support data in the areas of spacecraft ephemeris and orientation and instrument pointing and field-of-view are documented. It is intended that this document represent a cradle-to-grave chronicle of these activities. To satisfy this intent while facilitating the ready dissemination of information, the document is being published twice. The first publication, scheduled for release prior to ASTP liftoff, includes all preflight phases of the experiment support activity in addition to those appendixes that do not pertain to any mission-specific data. The second publication will provide any required updates to the original documentation and will add all mission-specific data, including documentation of all postflight data processing activities and data archiving information. Author

N75-28089*# Louisiana State Univ., Baton Rouge. Dept. of Chemical Engineering.

FINITE-RATE CHEMISTRY EFFECTS UPON CONVECTIVE AND RADIATIVE HEATING OF AN ATMOSPHERIC ENTRY VEHICLE

Perez Guillermo [1975] 336 p refs
(Grant NGR-19-001-059)
(NASA-CR-132698) Avail: NTIS HC $9.50 CSCL 22C

A mathematical model of the aerothermochemical environment along the stagnation line of a planetary return spacecraft using an ablative thermal protection system was developed and solved for conditions typical of atmospheric entry from planetary missions. The model, implemented as a FORTRAN 4 computer program, was designed to predict viscous, reactive and radiative coupled shock layer structure and the resulting body heating rates. The analysis includes flow field coupling with the ablator surface, binary diffusion, coupled line and continuum radiative and equilibrium or finite rate chemistry effects. The gas model used includes thermodynamic, transport, kinetic and radiative properties of air and ablation product species, including 19 chemical species and 16 chemical reactions. Specifically, the impact of nonequilibrium chemistry effects upon stagnation line shock layer structure and body heating rates was investigated. Author

N75-28090*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE MOTION OF THROW AWAY DETECTORS RELATIVE TO THE SPACE SHUTTLE

Larry D. Mullins 30 Jun. 1975 133 p refs
(NASA-TM-X-64948) Avail: NTIS HC $5.75 CSCL 22A

The motions of throw away detectors (TAD's) are analyzed using the linearized relative motion equations. The TAD's are to be used in the amps program as diagnostic instruments for making various measurements near the shuttle. The TAD's are ejected from the shuttle in arbitrary directions with small relative velocities (0.1 to 1.0 m/s) their subsequent trajectories relative to the shuttle are analyzed. Initial conditions that are likely to result in recontact between the TAD and the shuttle are identified. The sensitivity of the motion to variations in the initial conditions, possibly resulting from inaccuracy in the ejection mechanism, are analyzed as are effects of atmospheric drag. A targeting method, a method of giving the TAD correct initial conditions such that it will pass through a given point relative to the shuttle at a given time, is developed. The results of many specific cases are presented in graphical form. Author

N75-28091*# Chrysler Corp., New Orleans, La. Space Div.

INVESTIGATION OF SPACE SHUTTLE VEHICLE 140C CONFIGURATION ORBITER (MODEL 16-0) WHEEL WELL PRESSURE LOADS IN THE ROCKWELL INTERNATIONAL 7.75 X 11 FOOT WIND TUNNEL (OA143)

R. C. Mennell (Rockwell Intern., Los Angeles, Calif.) Jun. 1975 563 p
(Contract NAS9-13247)
(NASA-CR-141548; DMS-DR-2221) Avail: NTIS HC $13.00 CSCL 22B

Experimental aerodynamic investigations were conducted on a sting mounted .0405-scale representation of the 140C outer mold line space shuttle orbiter configuration in the Rockwell International 7.75 x 11.00 foot low speed wind tunnel. The primary test objectives were to define the orbiter wheel well

pressure loading and its effects on landing gear thermal insulation and to investigate the pressure environment experienced by both the horizontal flight nose probe and air vent door probes. Steady state and dynamic pressure values were recorded in the orbiter nose gear well, left main landing gear well, horizontal flight nose probe, and both left and right air vent door probe. All steady state pressure levels were measured by Statham differential pressure transducers while dynamic pressure levels were recorded by Kulite high frequency response pressure sensors. Author

N75-28092# Ballistic Research Labs., Aberdeen Proving Ground, Md.
LIMIT MOTIONS OF A SLIGHTLY ASYMMETRIC REENTRY VEHICLE ACTED ON BY CUBIC DAMPING MOMENTS Final Report
Charles H. Murphy and James W. Bradley Jan. 1975 36 p refs
(DA Proj. 1T1-61102-A-33D)
(AD-A005165; BRL-1755) Avail: NTIS CSCL 16/2

Although the linear damping moment on a symmetric missile is the same for planar motion as for coning motion, nonlinear damping for these different motions is not necessarily the same. The general cubic nonlinear damping expression requires the use of two coefficients and such damping can cause either circular or planar limit motion. The addition of configurational asymmetry introduces the possibility of more complicated limit motion. The existence of one-, two- and three-mode stable limit motions is studied by quasi-linear analysis and the results verified by numerical integration of the exact differential equation. GRA

N75-28093# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
MINIMUM FUEL CONTINUOUS LOW THRUST ORBITAL TRANSFER M.S. Thesis
Eugene A. Smith Dec. 1974 93 p refs
(AD-A005280; GA/MC/74-5) Avail: NTIS CSCL 22/3

Minimum fuel continuous low thrust orbit transfer is an optimal control problem which requires the application of iterative numerical methods to solve the resulting two point boundary value problem. A combination gradient-neighboring extremal algorithm gives accurate results when both the initial and terminal orbits are coplanar. These results are then used to extend the problem to include out-of-plane transfers between orbits of widely varying inclination. Control histories, in terms of thrust direction, are plotted as a function of time for both coplanar and non-coplanar transfers. Steering programs for coplanar transfers are characterized by a rapid thrust reversal which is dependent on eccentricity for the time of its occurrence. In the latter case, out-of-plane thrusting is primarily a function of the inclination change between orbits. On the basis of these results, the particular numerical approach used provides an effective method for generating optimal low thrust orbital transfer guidance. GRA

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, mobile transporters; and simulators.

For related information see also *09 Research Support Facilities (Air)*.

No abstracts in this category.

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; manned orbital laboratories; reusable vehicles; and space stations.

N75-28094* National Aeronautics and Space Administration, Washington, D.C.
NASA TO LAUNCH EUROPEAN COSMIC RAY EXPERIMENTAL SATELLITE
[1975] 10 p
(NASA-News-Release-75-214) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757 Baltimore/Washington Intern. Airport, Md. 21240 CSCL 22D

Europe's first observatory satellite (COS-B) designed for extraterrestrial gamma radiation study and launched on a Delta rocket for the European Space Agency (ESA) by NASA is briefly described. The COS-B's mission objectives are given along with launch operations. J.M.S.

N75-28095 AEG-Telefunken, Backnang (West Germany).
PROJECT HIGH PERFORMANCE SATELLITE, 3RD SYSTEMS STUDY. VOLUME 3, PART 2: SYSTEMS SPECIFICATIONS Final Report [PROJEKT HOCHLEISTUNGSSATELLIT. 3.SYSTEMSTUDIE. BERICHT 3, TEIL 2: SYSTEMSPEZIFIKATIONEN]
25 Mar. 1975 184 p In GERMAN
(Contract RV-2/1-V-34/74-QH)
Avail: Issuing Activity

Systems specifications of a German television satellite (high performance satellite, HLS) are defined. Power supplies and circuits, thermal control, attitude control and station keeping, broadcasting equipment, and cabling are described and functional block diagrams drawn. Test requirements are outlined. ESRO

N75-28096 AEG-Telefunken, Backnang (West Germany).
PROJECT HIGH PERFORMANCE SATELLITE, 3RD SYSTEMS STUDY. VOLUME 2: SUMMARIZING DESCRIPTION OF PERFORMANCES Final Report [PROJEKT HOCHLEISTUNGSSATELLIT. 3. SYSTEMSTUDIE. BERICHT 2: ZUSAMMENFASSENDE DARSTELLUNG DER LEISTUNGSFAEHIGKEIT EINES HOCHLEISTUNGSSATELLITEN]
[1975] 59 p In GERMAN
(Contract RV-2/1-V-34/74-QH)
Avail: Issuing Activity

The German high performance satellite, developed for television broadcasting, is described together with associated ground support stations. Onboard system specifications are outlined: i.e. solar power sources, power control, temperature control, attitude control and station keeping, mechanical drives for three-axis stabilization, communication equipment characteristics, and wiring diagrams. ESRO

N75-28097* National Aeronautics and Space Administration, Washington, D.C.
VIKING
Feb. 1972 33 p
(NASA-News-Release-75-42) Avail: NASA Scientific and Technical Information Facility, P.O. Box 8757, Baltimore/Washington Intern. Airport, Md. 21240 CSCL 22A

The Viking missions to Mars in 1975 are described. Included are descriptions of the tracking systems, Mars orbit and landing, the orbiter, investigations related to the search for life on Mars, and experiments in other areas such as molecular analysis, water detection, thermal mapping, radio science, inorganic chemistry, imaging systems, and lander camera. M.J.S.

N75-28098*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
PRELIMINARY VIBRATION, ACOUSTIC, AND SHOCK DESIGN AND TEST CRITERIA FOR COMPONENTS ON THE HEAO-C SPACECRAFT
Jul. 1975 49 p
(NASA-TM-X-64946) Avail: NTIS HC $3.75 CSCL 22B

The vibration, acoustic, and shock specification test criteria for spacecraft components and subassemblies and for the high Energy Astronomy Observatory (HEAO-C) experiments are presented. The HEAO-C was divided into zones and subzones to obtain simple component groupings. Zones are designated primarily to assist in determining the applicable specification. A subzone (general specification) is available for use when the location of the component is known but component design and

weight are not well defined. When the location, weight, and mounting configuration of the component are known, the appropriate subzone weight ranges (-A, -B, etc.) are available. Experiment and specific component specifications are available.
Author

N75-28099# Naval Research Lab., Washington, D.C.
SATELLITE SPIN AXIS CONTROL
Grant Duncan 31 Dec. 1974 20 p refs
(NRL Proj. A01-20; WF52551701)
(AD-A005395; NRL-7824) Avail: NTIS CSCL 22/1

Satellite attitude control comprises two parts: determining the orientation in inertial space and positioning a spin axis in this space. Two measured spherical angles of the sun and one computed angle for the earth are used in describing acquisition of the spin axis, avoiding ambiguities in the calculated angles. Maneuvering the spin axis by intermittent thruster pulses can be determined from expressions for rigid-body dynamics adjusted for the motion of the satellite and its spin axis. Errors and error estimates that enter both parts have been treated; nonimpulsive thrusts and nonconstant spin rates were also considered. GRA

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation e.g., shuttle operations; and rescue techniques.

For related information see also *03 Air Transportation and Safety* and *85 Urban Technology and Transportation*.

No abstracts in this category.

17 SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications*.

N75-28100*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
TRACKING AND DATA SYSTEM SUPPORT FOR THE PIONEER PROJECT. VOLUME 3: PIONEER 10 FROM 1 APRIL 1972 THROUGH THE JUPITER ENCOUNTER PERIOD, JANUARY 1974
R. B. Miller 15 Jun. 1975 187 p refs
(Contract NAS7-100)
(NASA-CR-143250; JPL-TM-33-584-Vol-3) Avail: NTIS HC $7.00 CSCL 22A

The Tracking and Data Systems support of the Pioneer 10 mission from April 1, 1972 through the Jupiter encounter period which ended January 5, 1974 is described. The period covered involves operations in the interplanetary environment from the time of completion of the second trajectory correction to the start of Jupiter encounter; the implementation, planning, and testing that lead to the Jupiter encounter; and the operations during the 60 day encounter period. Author

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes spacecraft thermal and environmental control; and attitude control.

For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance* and *39 Structural Mechanics*.

N75-28101*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC RESULTS OF A SEPARATION EFFECTS TEST ON A 0.01-SCALE MODEL (52-OTS) OF INTEGRATED SSV IN THE AEDC/VKF 40-BY-40 INCH SUPERSONIC WIND TUNNEL A, VOLUME 1
J. H. Campbell, II (Rockwell Intern., Downey, Calif.) Jun. 1975 983 p
(Contract NAS9-13247)
(NASA-CR-141541; DMS-DR-2192-Vol-1) Avail: NTIS HC $21.25 CSCL 22B

Experimental aerodynamic investigations were conducted, during the period July 18-19, 1974, in the AEDC/VKF Tunnel A facility on a 0.01-scale model (52-OTS) of the integrated space shuttle vehicle, including only one SRB. The purpose of the investigation was to obtain data for close-in proximity (SRB to orbiter/tank) effects with the orbiter/tank combination at relatively high alpha and beta attitudes, and with the SRB separation motors off. The AEDC Captive Trajectory System (CTS), which supported the SRB, was used in conjunction with the tunnel primary sector (supporting the orbiter/tank) to obtain grid type separation effects data. The one symmetrical SRB model was used interchangeably to obtain both right-hand and left-hand SRB data. Free-stream data were also obtained for the orbiter/tank and for the SRB. This data was used to provide baselines for proximity effects. The entire investigation was conducted at a free-stream Mach number of 4.5 with unit Reynolds number ranging from 4.0 to 6.5 million per foot. Author

N75-28102*# Scientific Translation Service, Santa Barbara, Calif.
SALYUT-4: THERMOREGULATORY SYSTEM
B. Gerasimov and N. Zheleznov Washington NASA Jun. 1975 9 p Transl. into ENGLISH of Sotsialisticheskaya Industriya (Moscow), 4 Feb. 1975 p 3 and Pravda Vostoka (USSR) 6 Feb. 1975 p 4
(Contract NASw-2483)
(NASA-TT-F-16324) Avail: NTIS HC $3.25 CSCL 22B

The Salyut 4 thermoregulator system is described. The multilayered outer coving of the craft is made of aluminum covered synthetic with a fiberglass lining. Heating and cooling units are incorporated in a system of radiators, which are located throughout the spacecraft walls. A system of thermal pipes containing a freon-type material was tested as a backup system. An experimental unit, called Labyrinth, for studying processes of evaporation in space was also tested. This unit can provide immediate additional cooling by the disposal of water broken down into molecules outside the spacecraft. Author

N75-28103*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DATA CORRELATION AND ANALYSIS OF ARC TUNNEL AND WIND TUNNEL TESTS OF RSI JOINTS AND GAPS, PHASE 2. VOLUME 1: TECHNICAL REPORT Final Report, 20 May 1974 - 19 May 1975
H. E. Cristensen 19 May 1975 344 p refs 2 Vol.
(Contract NAS9-14012)
(NASA-CR-141925; MDC-E1248-Vol-1; JSC-09651-Vol-1) Avail: NTIS HC $9.50 CSCL 22B

Heat transfer data measured in gaps representative of those being employed for joints in the space shuttle reusable surface insulation (RSI) thermal protection systems (TPS) were assimilated, analyzed, and correlated. Several types of gap were investigated with emphasis on simple butt joints. Gap widths ranged from 0.0 to 0.76 cm and depths ranged from 1 to 6 cm. Laminar, transitional, and turbulent boundary layer flows over the gap opening were investigated. The angle between gap axis and external flow was varied between 0 and pi/2 radians. The contoured cross section gap performed significantly better than all other wide gaps and slightly better than all other narrow gap geometries. Three dimensional heating variations were observed within gaps in the absence of external flow pressure gradients. Interactions between heating within gaps and heating of adjacent top tile surfaces were observed. Gaps aligned with the flow were observed to promote boundary layer transition. Heat transfer correlation equations were obtained for many of the tests. The TPS thickness requirements with and without gaps were computed for a current shuttle entry trajectory. Experimental data employed in the study are summarized. A description of each test facility, run schedule and test conditions,

model descriptive information, and heat flux data are included.
Author

N75-28104*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DATA CORRELATION AND ANALYSIS OF ARC TUNNEL AND WIND TUNNEL TESTS OF RSI JOINTS AND GAPS, PHASE 2. VOLUME 2: DATA REPORT, PART 1 Final Report, 20 May 1974 - 19 May 1975
H. E. Christensen 19 May 1975 568 p 2 Vol.
(Contract NAS9-14012)
(NASA-CR-141926; MDC-E1248-Vol-2) Avail: NTIS HC $13.00 CSCL 22B
For abstract, see N75-28103.

N75-28105*# McDonnell-Douglas Astronautics Co., St. Louis, Mo.
DATA CORRELATION AND ANALYSIS OF ARC TUNNEL AND WIND TUNNEL TESTS OF RSI JOINTS AND GAPS, PHASE 2. VOLUME 2: DATA REPORT, PART 2 Final Report, 20 May 1974 - 19 May 1975
H. E. Christensen 19 May 1975 425 p refs 2 Vol.
(Contract NAS9-14012)
(NASA-CR-141927; MDC-E1248-Vol-2; JSC-09651-Vol-2) Avail: NTIS HC $10.50 CSCL 22B
For abstract, see N75-28103.

N75-28106*# Martin Marietta Aerospace, Denver, Colo.
PAYLOAD/ORBITER CONTAMINATION CONTROL ASSESSMENT SUPPORT Final Report
R. O. Rantanen and E. B. Ress 27 Jun. 1975 235 p refs
(Contract NAS9-14212)
(NASA-CR-141939; MCR-75-13) Avail: NTIS HC $7.50 CSCL 22B

The development and use is described of a basic contamination mathematical model of the shuttle orbiter which incorporates specific shuttle orbiter configurations and contamination sources. These configurations and sources were evaluated with respect to known shuttle orbiter operational surface characteristics and specific lines-of-sight which encompass the majority of viewing requirements for shuttle payloads. The results of these evaluations are presented as summary tables for each major source. In addition, contamination minimization studies were conducted and recommendations are made, where applicable, to support the shuttle orbiter design and operational planning for those sources which were identified to present a significant contamination threat.
Author

N75-28107*# Chrysler Corp., New Orleans, La. Space Div.
WIND TUNNEL TEST 0A113 OF THE 0.010-SCALE SPACE SHUTTLE ORBITER MODEL 51-0 IN THE CALSPAN HYPERSONIC SHOCK TUNNEL (48-INCH LEG)
R. R. Burrows (Rockwell Intern. Corp., Downey, Calif) and C. E. Rogers (Calspan Corp.) Jul. 1975 124 p refs
(Contract NAS9-13247)
(NASA-CR-141547; DMS-DR-2234) Avail: NTIS HC $5.25 CSCL 22B

Results are presented of wind tunnel test conducted Hypersonic Shock Tunnel using a 0.010-scale 140A/B configuration orbiter model designated 51-0. The test objectives were: (1) to obtain force and moment data at various Mach numbers and Reynolds numbers from which viscous interaction effects on stability and control may be determined. (1) To provide flow visualization data from which the effects of control surface separation may be evaluated. and (3) To obtain pressure data in conjunction with force and moment data to assist in analyzing viscous interaction and flow separation effects. Data were obtained at angles-of-attack of 20 deg, 30 deg, 40 deg, and 50 deg. The Mach number range covered was from 10 to 16 and the viscous interaction parameter range was from 0.01 to 0.06.
Author

N75-28108*# Rockwell International Corp., Downey, Calif. Space Div.
APOLLO-SOYUZ TEST PROJECT CSM 111/DM-2/DS 5/SLA 18 FLIGHT READINESS REVIEW PREBOARD REPORT, JSC
4 Jun. 1975 167 p
(Contract NAS9-13100)
(NASA-CR-141924; AP75-17) Avail: NTIS HC $6.25 CSCL 22B

Spacecraft systems (fuel, electrical) are analyzed for performance prior to launch. Systems failures are examined, and safety precautions and safety devices are reviewed. Spacecraft configurations of the command module and docking system are shown.
J.R.T.

N75-28109*# Chrysler Corp., New Orleans, La.
HEAT TRANSFER PHASE CHANGE PAINT TESTS OF 0.0175-SCALE MODELS (NOS. 21-0 AND 46-0) OF THE ROCKWELL INTERNATIONAL SPACE SHUTTLE ORBITER IN THE AEDC TUNNEL B HYPERSONIC WIND TUNNEL (TEST OH25A)
W. H. Dye Jul. 1975 252 p refs Prepared by Rockwell Intern.
(Contract NAS9-13247)
(NASA-CR-141546; DMS-DR-2252) Avail: NTIS HC $8.50 CSCL 22B

Tests were conducted in a hypersonic wind tunnel using various truncated space shuttle orbiter configurations in an attempt to establish the optimum model size for other tests examining body shock-wing leading edge interference effects. The tests were conducted at Mach number 8 using the phase change paint technique. A test description, tabulated data, and tracings of isotherms made from photographs taken during the test are presented.
Author

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography*.

N75-28110*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
MIT'S ROLE IN PROJECT APOLLO. VOLUME 2: OPTICAL, RADAR, AND CANDIDATE SUBSYSTEMS Final Report
Mar. 1972 261 p refs
(Contracts NAS9-153; NAS9-4065; DSR Proj. 55-23890)
(NASA-CR-141898; R-700-Vol-2) Avail: NTIS HC $8.50 CSCL 22B

The development of optical, radar, and candidate subsystems for Project Apollo is discussed. The design and development of the optical subsystems for both the Apollo command and lunar spacecraft are described. Design approaches, problems, and solutions are presented. The evolution of radar interfaces with the GN&C system is discussed; these interfaces involved both hardware and software in a relatively complex interrelationship. The design and development of three candidate subsystems are also described. The systems were considered for use in Apollo, but were not incorporated into the final GN&C system. The three subsystems discussed are the star tracker-horizon photometer, the map and data viewer and the lunar module optical rendezvous system.
Author

N75-28828* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCD IMAGING INSTRUMENTS FOR PLANETARY SPACECRAFT APPLICATIONS
Terrence H. Reilly and Mark Herring *In its* Proc.: Symp. on Charged-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 46-64 (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 14B

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components e.g., rocket engines; and spacecraft auxiliary power sources.

For related information see also *07 Aircraft Propulsion, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N75-28111 Colorado State Univ., Fort Collins.
ACOUSTIC LINER SUPPRESSION OF NONLINEAR COMBUSTION OSCILLATIONS Ph.D. Thesis
William Robert Espander 1974 74 p
Avail: Univ. Microfilms Order No. 75-14655

An analytical model formulated for a three-dimensional nonlinear stability problem in a rocket motor combustion chamber is presented. The chamber was modeled as a right circular cylinder with a short (multi-orifice) nozzle, and an acoustic liner covering an arbitrary portion of the cylindrical periphery. The combustion was concentrated at the injector and the gas flow field was characterized by a mean Mach number. The unsteady combustion processes were formulated using the Crocco time lag model. The resulting equations were solved using a Green's function method combined with numerical evaluation techniques. The influence of acoustic liners on the nonlinear waveforms was predicted. Nonlinear stability limits and regions where triggering is possible were also predicted for both lined and unlined combustors in terms of the combustion parameters.
Dissert. Abstr.

N75-28112*# Aerojet Solid Propulsion Co., Sacramento, Calif.
DETERMINATION OF FAILURE LIMITS FOR STERILIZABLE SOLID ROCKET MOTOR Final Report
W. L. Lambert, E. J. Mastrolia, and J. D. McConnell Dec. 1974 75 p Prepared for JPL
(Contracts NAS7-100; JPL-953848)
(NASA-CR-143251) Avail: NTIS HC $4.25 CSCL 21H

A structural evaluation to establish probable failure limits and a series of environmental tests involving temperature cycling, sustained acceleration, and vibration were conducted on an 18-inch diameter solid rocket motor. Despite the fact that thermal, acceleration and vibration loads representing a severe overtest of conventional environmental requirements were imposed on the sterilizable motor, no structural failure of the grain or flexible support system was detected. The following significant conclusions are considered justified. It is concluded that: (1) the flexible grain retention system, which permitted heat sterilization at 275 F on the test motor, can readily be adopted to meet the environmental requirements of an operational motor design, and (2) if further substantiation of structural integrity is desired, the motor used is considered acceptable for static firing.
Author

N75-28113*# Aerojet Liquid Rocket Co., Sacramento, Calif.
COMPARISON STUDY OF FLUORINE/HYDRAZINE ENGINE CONCEPTS Final Report
R. C. Schindler Nov. 1974 270 p ref Prepared for JPL
(Contracts NAS7-100; JPL-953943)
(NASA-CR-143249; Rept-2094-FR-1) Avail:- NTIS HC $8.50 CSCL 21H

The weight and performance were examined of 600 lbF thrust liquid-liquid and bimodal engines as chamber pressure, mixture ratio, contraction ratio, combustion chamber and nozzle lengths, area ratio, and operating duration were varied. Results show the bimodal engine to have a lower weight, shorter length, and slightly higher performance over the entire range of operating conditions. Advanced engine designs were also considered. It was determined that the weight of a bimodal engine with a ducted thrust chamber using hydrazine decomposition products for a combination of regenerative, inter-regen, and film cooling would be nearly independent of operating duration. The length of the combustion chamber of the liquid-liquid engine can be reduced by the incorporation of a splash-plate element transverse-platelet injector to obtain improved fuel atomization and vaporization. The use of this injector would result in the performance and weight of the liquid-liquid engine being virtually the same as that of the baseline bimodal engine.
Author

N75-28114# United Kingdom Atomic Energy Authority, Culham (England).
COLLOID THRUSTORS Final Report
Aug. 1974 250 p refs
(Contract ESTEC-1719/72-Hp)
(CLM/RR/E1/19; ESRO-CR(P)-657) Avail: NTIS HC $7.50

Results of long duration tests on both raised edge and coplanar colloid thrustors are reported and studies of possible flight type systems are presented. It is demonstrated that colloid thrustors can be designed to meet some of the basic flight specifications and that operation up to at least 1000 hours is feasible even in an excessively hostile environment. Physical and technological aspects of flight type colloid systems are discussed. An analysis is given of radiation induced decomposition that effects the long term propulsive efficiency of colloid thrustors. For individual titles, see N75-28115 through N75-28118.

N75-28115 United Kingdom Atomic Energy Authority, Culham (England).
LONG DURATION PERFORMANCE OF A CO-PLANAR EMITTER WITH P-Ir TIPS
M. F. A. Harrison, E. S. Hotston, and R. G. Montague *In its* Colloid Thrustors Aug. 1974 40 p refs (For availability see N75-28114 19-20)

On the basis of tests, the raised edge emitter thrustor has a superior performance over a coplanar configuration, and the advantage that it does not require a difficult mechanical alignment of two tips. The test demonstrated that Pt-Ir tips can survive for at least 1000 hours in the hostile environment of these laboratory tests. Further investigation is necessary to understand the propellant loss mechanisms.
ESRO

N75-28116 United Kingdom Atomic Energy Authority, Culham (England).
COMMENTS ON SOME OF THE PROCESSES WHICH MAY GOVERN THE EMISSION OF DROPLETS FROM COLLOID THRUSTORS
E. Hotston and M. F. A. Harrison *In its* Colloid Thrustors Aug. 1974 48 p refs (For availability see N75-28114 19-20)

Several plausible models of the mechanisms which control the emission of droplets are discussed. Recent results have established that, for certain ill defined conditions, considerably more propellant is fed to a thrustor than is emitted in the form of charged and hence accelerated droplets. To resolve the problem of poor propellant utilization, a study was made of emission mechanisms, limited to new and advanced concepts of thrustor operation. Models discussed include: continuous electrolyte current model, hydrodynamic instability emission model, and Taylor jet model.
ESRO

N75-28117 United Kingdom Atomic Energy Authority, Culham (England).
A PILOT STUDY OF COLLOID THRUSTOR SYSTEMS
M. F. A. Harrison and E. S. Hotston *In its* Colloid Thrustors Aug. 1974 125 p refs (For availability see N75-28114 19-20)

Physical and technological aspects of flight-type colloid systems and their mission capability are discussed, together with detailed assessments of their present and future development status. Baseline specifications are presented for a feasible engineering prototype of a thrustor module, and the development of this module into a flight-type system is considereo along with the principles of flight-type control. Estimates are made of the system mass, power requirements, operating lifetime, and thrusting strategy for colloid systems used for north-south station keeping of ESRO satellites.
ESRO

N75-28118 Manchester Univ. (England). Dept. of Chemistry.
A CHEMICAL INVESTIGATION OF SODIUM IODIDE/GLYCEROL PROPELLANT FOR COLLOID THRUSTORS
D. R. McCracken and M. A. J. Rodgers *In* UKAEC Colloid Thrustors Aug. 1974 29 p (For availability see N75-28114 19-20)

Experimental work on radiation induced decomposition that affects the long term propulsive efficiency of colloid thrustors is reported. The chemical decomposition in the thrustor is shown to be caused mainly by backscattered electron irradiation of the emitter; the effects being extremely deleterious to the propellant and the thrustor efficiency. The radiation chemistry of some

pyridinium compounds which were studied as possible additives to reduce chemical decomposition in the thrustor and to improve the stability of the system is described. It is shown that this class of compounds contains powerful radical and electron scavengers which can suppress both hydrogen and polymer formation. ESRO

23 CHEMISTRY AND MATERIALS (GENERAL)

Includes biochemistry and organic chemistry.

N75-28119# Materials Research Labs., Maribyrnong (Australia).
PEROXYOXALATE CHEMILUMINESCENCE FLUORESCER, OXALATE ESTER AND DETERIORATION STUDIES
C. D. Dowd, P. J. Hanhela, and D. B. Paul Nov. 1974 37 p refs
(TN-349) Avail: NTIS HC $3.75

Three fluorescent compounds which emit in the yellow region of the spectrum were synthesized. All are stable in chemiluminescent reactions, and their relative efficiences were determined. The fluorescer, 5,12-bis(phenylethynyl)tetracene, reported to emit in the red region of the spectrum, was synthesized and examined. Although this compound is an efficient fluorescer in chemiluminescent reactions, the color of the emission is described as orange-red. Two orange fluorescers were obtained; one of these is unstable under chemiluminescent conditions. Yellow-green fluorescers superior in efficiency to the material currently used in the only commercially available product were prepared. An infrared emitting fluorescer was synthesized but was not evaluated due to lack of suitable instrumentation. Attempts to obtain a stable primary blue fluorescer were not successful. A number of new oxalate esters were prepared and studied, and deterioration studies of the commercial light stick were conducted. Author

N75-28120# Technische Hogeschool, Delft (Netherlands).
PROBLEMS IN SOLID PHASE PEPTIDE SYNTHESIS. SYNTHESIS OF SUBSTANCE P. Ph.D. Thesis [PROBLEMEN BIJ DE VASTE-FASE PEPTIDESYNTHESE SYNTHESE VAN SUBSTANCE P]
Johannes Leopold Marie Syrier 1975 98 p refs In DUTCH
Avail: NTIS HC $4.75

An investigation was conducted to determine the way in which the solid-phase method can be applied in the synthesis of peptides with C-terminal methionine amide, such as the tachykinines and the bombesine-like peptides. The model peptide chosen was the undecapeptide substance P, a possible neurotransmitter probably occurring in man and belonging to the tachykinines. The isolation, the determination of the sequence, the pharmacological properties, and the known syntheses of substance are described. Other methods of synthesizing substance P are discussed. Author

N75-28121*# Stanford Univ., Calif. Center for Materials Research.
MATERIALS RESEARCH AT STANFORD UNIVERSITY Annual Report, 1 Jul. 1974 - 20 Jun. 1975
Jul. 1975 361 p refs Sponsored by NASA
(NASA-CR-143274; AR-14; SU-CMR-75-12) Avail: NTIS HC $10.00 CSCL 11G

Research activity related to the science of materials is described. The following areas are included: elastic and thermal properties of composite materials, acoustic waves and devices, amorphous materials, crystal structure, synthesis of metal-metal bonds, interactions of solids with solutions, electrochemistry, fatigue damage, superconductivity and molecular physics and phase transition kinetics. J.M.S.

N75-28122# Army Foreign Science and Technology Center, Charlottesville, Va.
DIRECT SCARLET (ORGANIC DYE)
11 Jul. 1974 8 p Transl. into ENGLISH from Russian state standard GOST 4909-49 5 p
(AD-A005482; FSTC-HT-23-0786-74) Avail: NTIS CSCL 07/3

GOST 4909-49 applies to direct scarlet disazo-dye. The standard has six sections: I. Specification and Designation; II. Characteristics of the Standard Type; III. Technical Specifications; IV. Inspection Rules; V. Test Methods; VI. Packing and Labeling. Direct scarlet dye is used mainly for dyeing cotton fiber. GRA

N75-28123# Army Foreign Science and Technology Center, Charlottesville, Va.
AZO DYES
B. A. Poray-Koshits 12 Sep. 1974 206 p refs Transl. into ENGLISH from unidentified Russian language mono., Leningrad, 1972 1-60 p
(AD-A005484; FSTC-HT-23-0946-74) Avail: NTIS CSCL 07/3

In this general text on azo dyestuffs, a historical survey of the development of azo dye technology is followed by a discussion of the chemical reactions and mechanisms underlying synthetic dye derivation. Specific descriptions, methods of derivation and applications of dyes, soluble and insoluble in water and organic compounds, are given. The structures of all the important dyes discussed are pictured throughout the text and in tables. GRA

N75-28124# Iowa Univ., Iowa City. Dept. of Chemistry.
HEAT STABLE POLYMERS: POLYPHENYLENE AND OTHER AROMATIC POLYMERS Final Report, Jan. 1971 - Dec. 1973
John K. Stille and Robert G. Nelb 1 Jun. 1974 46 p refs
(Grants DA-ARO(D)-31-124-71-G44; DA-ARO(D)-31-124-72-G66; DA-ARO(D)-31-124-72-G104)
(AD-781546; AROD-5199-21-C) Avail: NTIS CSCL 07/3

The Diels-Alder reaction of cyclopentadienones with acetylenic dienophiles is used to synthesize polyphenylenes. Isomer studies were performed on model compounds of phenylated polyphenylenes. Results indicate that about 50% of the linkages in the phenylated polyphenylene are meta catenated which may account for their good solubility. A phenylated polyphenylene containing fewer pendant phenyls per repeating unit was synthesized. A synthetic route to p-bis-2-pyrone was developed allowing larger quantities of monomer to be prepared. The model reaction of 3,4-diphenylthiopene dioxide with phenylacetylene demonstrated that this reaction is not a suitable polymer forming reaction since dimerization of the sulfone competes with acetylene addition. Model reactions leading to poly (p-phenylene) containing removable chromium tricarbonyl arene complexes to improve solubility during polymer formation were studied. Author (GRA)

N75-28125# Alabama Univ., University. Dept. of Chemistry.
PREPARATION AND PROPERTIES OF ETA 6-TRICARBONYLCHRONIUM: COMPLEXED ARYLENESILOXANE POLYMERS
Charles U. Pittman, Jr., William J. Patterson, and Samuel P. McManus 15 Jan. 1975 23 p refs
(Contract N00014-73-A-0361)
(AD-A004951; TR-10) Avail: NTIS CSCL 07/3

Poly(tetramethyl-p-silphenylenesiloxane), 1, and poly (methylphenylsiloxane), 2, were prepared and subsequently reacted with hexacarbonylchromium to generate their eta 6-Cr(CO)3 complexed analogs 3 and 4 respectively. During the complexation reaction, competing decomposition to chromium salts took place. Furthermore a competing chain scission reaction took place resulting in lower molecular weights for the complexed polymers. Heating 3 and 4 resulted in carbon monoxide evolution and the presence of eta 6-Cr(CO)3 moieties lowered the thermal stability of the polymers. GRA

N75-28126# Alabama Univ., University. Dept. of Chemistry.
MIXED VALENCE, SEMICONDUCTING FERROCENE: CONTAINING POLYMERS
Charles U. Pittman, Jr., Yukihiko Sasaki, and Tapan K. Mukherjee 15 Jan. 1975 8 p refs
(Contract N00014-73-A-0361)
(AD-A004950; TR-9) Avail: NTIS CSCL 07/3

Both conjugated and nonconjugated ferrocene polymers were partially oxidized by dichlorodicyanoquinone (DDQ), tetracyanoquinodimethan (TCNQ), and I2 to give mixed valence semiconducting polymers. GRA

N75-28127# Alabama Univ., University. Dept. of Chemistry.
SELECTIVE CATALYTIC OLIGOMERIZATIONS AND HYDROGENATIONS USING POLYMER-ANCHORED COMPLEXES OF Ni AND Ir
Stephen E. Jacobson and Charles U. Pittman, Jr. 15 Jan. 1975 9 p refs
(Contract N00014-73-A-0361)
(AD-A004944; TR-3) Avail: NTIS CSCL 07/3

Polystyrene-divinylbenzene resin-anchored Ni(CO)2(PPh3)2 has been used to selectively oligomerize butadiene to either 4-vinyl-cyclohexene or 1,5-cyclooctadiene. Anchored Ir(Cl) (CO) (PPh3)2 selectively catalyzes the hydrogenation of 1,5-cyclooctadiene to cyclooctene. The activity of these catalysts in some cases surpasses that of their homogeneous counterparts under identical conditions. GRA

N75-28128# Alabama Univ., University. Dept. of Chemistry.
HETEROGENIZED HOMOGENEOUS CATALYSTS. HYDROGENATION OF METHYL SORBATE BY POLYSTYRENE-ANCHORED TRICARBONYLCHROMIUM
Charles U. Pittman, Jr., Bong T. Kim, and Walter M. Douglas 15 Jan. 1975 18 p refs
(Contract N00014-73-A-0361)
(AD-A004945; TR-4) Avail: NTIS CSCL 07/3

The reaction of a swollen 1% divinylbenzene-crosslinked polystyrene with hexacarbonylchromium gave polymer-anchored tricarbonylchromium moieties eta(6)-bonded to the polypolymer's phenyl rings. Using this heterogenized catalyst, methyl sorbate was converted selectively (96-97%) to (Z)-methyl 3-hexenoate with small amounts of methyl hexanoate and (E)-methyl 2-hexenoate in cyclohexane at 160C and 500psi of hydrogen. The product distribution was sensitive to solvent and reaction temperature. No significant hydrogenation of cyclohexene or (E,E,E)-1,5,9-cyclododecatriene occurred at 150C and 500psi of hydrogen in 24 hrs. This heterogenized homogeneous catalyst system is discussed in relation to known homogeneous hydrogenation catalysts for methyl sorbate. GRA

N75-28129# Alabama Univ., University. Dept. of Chemistry.
CATALYTIC REACTIONS USING POLYMER-BOUND VERSUS HOMOGENEOUS COMPLEXES OF Ni, Rh, AND Ru
Charles U. Pittman, Jr., Larry R. Smith, and Ronnie M. Hanes 15 Jan. 1975 37 p refs
(Contract N00014-73-A-0361)
(AD-A004946; TR-5) Avail: NTIS CSCL 07/3

A series of styrene-divinylbenzene resins were diphenylphosphinated and then complexed with the homogeneous catalysts (PPh3)2Ni(CO)2, (PPh3)3RhCl, (PPh3)3RhH(CO), and (PPh3)2RhCl2(CO)2. Reactions catalyzed by the polymer-anchored catalysts were compared with the same reactions carried out with the corresponding homogeneous catalyst. Butadiene cyclooligomerizations were effected. The rates of hydroformylation as a function of the polymer-bound -PPh2/Rh ratio, crosslink density, resin particle size, and diffusion effects are discussed. The effect of catalyst anchoring on hydrogenation rates was discussed for some cycloalkenes. A comparison of homogeneous versus anchored catalysts in terms of rates, diffusion, internal polymer mobility and product selectivity is made where possible. GRA

N75-28130# Alabama Univ., University. Dept. of Chemistry.
REACTIONS OF ETHYNYLFERROCENE AND 3,3,3-TRIFLUOROPROPYNE WITH (PPh3)2Ni(CO)2, Co2(CO)8, AND TRANS-(PPh3)2IrCl(CO)
Charles U. Pittman, Jr. and Larry R. Smith 15 Jan. 1975 24 p refs
(Contract N00014-73-A-0361)
(AD-A004948; TR-7) Avail: NTIS CSCL 07/3

Ethynylferrocene oligomerized to linear dimer, linear trimer, and 1,2,4-triferrocenylbenzene in the presence of (PPh3)2Ni(CO)2 and its polymer-anchored analogs. The rate of oligomerization decreased as the crosslink density of the anchored catalysts increased but the product distribution remained the same as using the soluble catalyst; 3,3,3-Trifluoropropyne did not oligomerize at temperatures to 150C. Ethynylferrocene was converted to mu-ferrocenylacetylenehexacarbonyl-dicobalt, upon reaction with one equivalent of Co2(CO)8. Reaction of ethynylferrocene with trans-(PPh3)2IrCl(CO) gives the six coordinate Ir(III) hydridoacetylide. Trifluoropropyne underwent oxidative addition with trans--(PPh3)2IrCl(CO) to give six coordinate hydridoacetylide, but no polymer was formed. GRA

N75-28131# Air Force Office of Scientific Research, Arlington, Va.
ANNUAL AFOSR CHEMISTRY PROGRAM REVIEW, (19TH) Special Scientific Report, 1973
Denton W. Elliott Jan. 1974 111 p refs
(AF Proj. 6813)
(AD-A005688; AFOSR-74-0273TR) Avail: NTIS CSCL 07/4

This review provides a record of research in progress, along with illustrative achievements resulting from the basic research program of the Directorate of Chemical Sciences, Air Force Office of Scientific Research (AFSC). The first section of the three principal sections presents various technical aspects. It contains articles on the JANAF Thermochemical Tables, AFOSR Organometallic Chemistry Research Program, Past and Present, Electrochemistry and Surface Chemistry. The second section contains program statistics. The third section consists of research efforts completed in Fiscal Year 1973. GRA

24 COMPOSITE MATERIALS

Includes laminates.

N75-28132 British Library Lending Div., Boston Spa (England).
POTENTIAL APPLICATIONS OF THE CHEMICAL VAPOUR DEPOSITION PROCESS IN THE DEVELOPMENT OF COMPOSITES
E. Poeschel Nov. 1973 18 p refs Transl. into ENGLISH from Z. Werkstofftech. (West Germany), no. 4, 1973 p 215-221 In ENGLISH and GERMAN
(BLL-BTI-0746-01493-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A description of the chemical vapor deposition process and its potential applications in the development of materials such as composites are presented. Topics discussed include the coating of powders (particle composites), the production of fibers, their coating with adhesive and wetting agents and with diffusion and reaction barriers (fiber composites), and the deposition of corrosion-inhibiting, heat-insulating, and wear-resistant surface layers (laminated composites). Author

N75-28133 British Library Lending Div., Boston Spa (England).
STUDIES OF THE RECRYSTALLIZATION BEHAVIOUR OF COLD-FORMED X10NiCrAlTi 32 20 (THERMAX 21/33)
A. B. Mende and R. Oppenheim 1973 9 p Transl. into ENGLISH from DEW Deut. Edelstahlwerke Tech. Ber. (Krefeld), v. 13, no. 1, 1973 p 19-22 In ENGLISH and GERMAN
(BLL-LTI-746-1495-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The interdependence of cold working, process annealing and the hot yield point of grade X 10 NiCrAlTi 32 20 (Thermax 21/30) steel was investigated to determine its suitability for the construction of heat exchanger pipes to be used in water cooled nuclear reactors. The relationship between tensile properties, degree of deformation, annealing temperature and annealing time was determined on work hardened Thermax 21/30 steel wire. The test results show that the cold worked and completely recrystallized steel fails to meet the reactor design specifications, so that a redrawing process would be involved which has important disadvantages. It seems more appropriate to use a suitable precipitation hardening Ti steel which does not require redrawing. Author

N75-28134 British Library Lending Div., Boston Spa (England).
THE VISCOSITY OF POLYETHYLENE PHTHALATE AND ITS SOLUTIONS IN ANISOLE AND NITROBENZENE OVER THE FULL RANGE OF TEMPERATURE AND CONCENTRATION. THE FREE AND HINDERED FLUID PHASE
K. Uaberreiter and D. Buhlke 15 May 1974 26 p refs Transl. into ENGLISH from Ber. Bunsenges. (West Germany) In GERMAN and ENGLISH
(BLL-NEL-TT-2540-(6075.461)) Avail: British Library Lending

Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The viscosities of polyethlene polyester and its solutions in anisole and nitrobenzene were measured in a small falling sphere viscosimeter in the molar ratios 1/10, 1/8, 1/4, 1/3, 1/2, 1/1, 1/0.5, and 1/0.2. By describing the measurements in terms of the Vogel equation, it was found possible to define two liquid phases: a hindered and a free fluid phase. Two hinder fluid phases could be determined for the pure anisole solvent, but only one for the solutions, owing to limited measuring range. The transition temperatures were calculated, assuming the free volumes to be additive. The effective critical volume for the viscous flow is larger in the free than in the hindered liquid phase. Author

N75-28135* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
METHOD OF PREPARING GRAPHITE REINFORCED ALUMINUM COMPOSITE Patent
Felix P. Laiacona, inventor (to NASA) Issued 15 Jul. 1975 5 p Filed 24 Mar. 1971
(NASA-Case-MFS-21077-1; US-Patent-3,894,677; US-Patent-Appl-SN-127481; US-Patent-Class-228-190; US-Patent-Class-29-419; US-Patent-Class-228-193) Avail: US Patent Office CSCL 11D

A metallic composite made up of an aluminum matrix and high-modulus graphite fibers coated with nickel is presented. The composite was prepared by applying a nickel coating to graphite fiber yarn, alining the yarn between aluminum sheets in a stacked array and heating the array under pressure to obtain diffusion bonding. Official Gazette of the U.S. Patent Office

N75-28136 Washington Univ., St. Louis, Mo.
STRENGTH OF COMPOSITES: EFFECTS OF STRESS STATE, ENVIRONMENT AND TIME Ph.D. Thesis
Douglas Charles Ruhmann 1974 216 p
Avail: Univ. Microfilms Order No. 75-14935

Objectives of this investigation were to develop a time/environment dependent failure criterion for anisotropic materials and to extend the kinetic theory of rate-dependent rupture to include both complex stress state and environment effects. The composite material used in the experimental characterization of time/environment dependent strength was a unidirectional E-glass fiber reinforced epoxy resin. An organic solvent, benzene, was used in the characterization of environment effects. Two supplemental investigations were conducted which were concerned with the interaction between the benzene and the glass-epoxy composite material. These investigations were a characterization of the sorption-kinetics of benzene by both the isotropic resin and anisotropic composite material and a determination of the effect of stress on the diffusion of benzene into the epoxy resin. Dissert. Abstr.

N75-28137 Maryland Univ., College Park.
DIVERGENCE ELIMINATION WITH ADVANCED COMPOSITES Ph.D. Thesis
Norris Jacob Krone, Jr. 1974 120 p
Avail: Univ. Microfilms Order No. 75-14306

The ability to tailor material properties to suit a particular loading situation was studied. The structural characteristics of an airfoil and elimination of the structural weight penalty normally associated with divergence prevention for swept-forward airfoils, and a comparison using aluminum and composite wing designs of various sweep angles is presented. The optimization of each design to determine the minimum weight necessary to satisfy the loading condition and the divergence criteria imposed was also studied. The results of the study show the undesirability of using swept-forward wing designs which incorporate isotropic materials, and in marked contrast with its aluminum counterpart, the composite structural weight variation with forward sweep is not found to be significant. Dissert. Abstr.

N75-28138 Illinois Univ., Urbana.
A STATISTICAL MODEL FOR PREDICTING THE BEHAVIOR OF GENERALIZED COMPOSITES Ph.D. Thesis
John Neil Majerus 1975 354 p
Avail: Univ. Microfilms Order No. 75-14139

A general model for composite materials was developed so that the influence of various component properties upon the localized fields and effective thermal-mechanical properties can be studied. Two types of inclusions are considered to be contained within a small continuum volume of the matrix material. Relationships were derived for the effective thermal-mechanical properties by using the definitions of both an effective property and an average property, and by introducing a statistical identity involving the first moment. Statistical ensemble averages were used instead of commonly employed mean value theorem. A solution technique was developed for predicting the internal temperature fields which involved using a pair-wise method of successive approximations in order to uncouple the fields. This set of equations was numerically evaluated using the method of weighted residuals combined with Gaussian and numerical quadrature and with Hamming's modified predictor-corrector method for numerical integration. A series of computer programs was written based upon the set of approximate equations. The temperature fields associated with the zero order successive approximation were determined for ellipsoidal, plate-like, and rod-like inclusions. Dissert. Abstr.

N75-28139 Rensselaer Polytechnic Inst., Troy, N.Y.
DEVELOPMENT AND EVALUATION OF HIGH-ENERGY BRAKE MATERIALS Ph.D. Thesis
Ting-Long Ho 1974 132 p
Avail: Univ. Microfilms Order No. 75-14943

An investigation was carried out to study and develop high temperature aircraft brake materials sliding against 17-22 AS steel. The requirements of brake materials were outlined and a survey made to select materials to meet these requirements. Based upon their physical and thermal properties, a number of metals and ceramic materials were selected and evaluated in sliding tests which simulated aircraft braking. These were nickel, molybdenum, tungsten, ZrO2, high temperature cements and carbons. Additives were then incorporated into these materials to optimize their wear or strength behavior with particular emphasis on nickel and molybdenum base materials and a high temperature potassium silicate cement. Optimum materials were developed which had improved wear behavior over conventional brake materials in the simulated test. Dissert. Abstr.

N75-28140 Texas A&M Research Foundation, College Station.
VISCOELASTIC CHARACTERIZATION OF A NONLINEAR, GLASS/EPOXY COMPOSITE INCLUDING THE EFFECTS OF DAMAGE Ph.D. Thesis
Scott Williams Beckwith 1974 423 p
Avail: Univ. Microfilms Order No. 75-15011

Isothermal creep and recovery tests were conducted on an epoxy resin and a glass fiber-reinforced composite made from the same bulk resin. The glass/epoxy which was studied included unidirectional and laminated (angle-ply) composites as well as samples removed from a Minuteman III solid rocket motor case. The creep and recovery tests were carried out at a series of stress levels well into the nonlinear region at temperatures of 20, 75 and 140 F for several fiber angles. Both the epoxy and glass/epoxy were found to be thermorheologically complex materials with a creep compliance which may be represented by a power law in time. The linear viscoelastic principal creep compliances were determined for the glass/epoxy using fourth-order tensor transformations. The nonlinear properties were found to depend primarily on the stress normal to the fiber, suggesting a crack opening mode as the essential mechanism of growth. Bending tests conducted on glass/epoxy beam and plate specimens brought out a strong influence of the strain gradient. Dissert. Abstr.

N75-28141*# Los Alamos Scientific Lab., N.Mex.
CARBIDE COATED FIBERS IN GRAPHITE-ALUMINUM COMPOSITES Progress Report, 1 Feb. - 31 Jul. 1974
Richard J. Imprescia, Leonard S. Levinson, Robert D. Reiswig, Terry C. Wallace, and Joel M. Williams Washington NASA Jul. 1975 20 p refs
(NASA Order L-75900)
(NASA-CR-2566; LA-5741-PR; PR-2) Avail: NTIS HC $3.25 CSCL 11D

The NASA-supported program at the Los Alamos Scientific Laboratory (LASL) to develop carbon fiber-aluminum matrix composites is described. Chemical vapor deposition (CVD) was used to uniformly deposit thin, smooth, continuous coats of TiC

on the fibers of graphite tows. Wet chemical coating of fibers, followed by high-temperature treatment, was also used, but showed little promise as an alternative coating method. Strength measurements on CVD coated fiber tows showed that thin carbide coats can add to fiber strength. The ability of aluminum alloys to wet TiC was successfully demonstrated using TiC-coated graphite surfaces. Pressure-infiltration of TiC- and ZrC-coated fiber tows with aluminum alloys was only partially successful. Experiments were performed to evaluate the effectiveness of carbide coats on carbon as barriers to prevent reaction between alluminum alloys and carbon. Initial results indicate that composites of aluminum and carbide-coated graphite are stable for long periods of time at temperatures near the alloy solidus.. Author

N75-28142*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
INDUSTRY TECHNOLOGY ASSESSMENT OF GRAPHITE-POLYMIDE COMPOSITE MATERIALS
Jun. 1975 416 p refs Conf. held at Williamsburg, Va., 17-19 Mar. 1975
(Contract NAS1-12436)
(NASA-CR-132685; MDC-G6002) Avail: NTIS HC $10.50 CSCL 11D

An assessment of the current state of the art and the future prospects for graphite polyimide composite material technology is presented. Presentations and discussions given at a minisymposium of major issues on the present and future use, availability, processing, manufacturing, and testing of graphite polyimide composite materials are summarized. Author

N75-28143*# Los Alamos Scientific Lab., N.Mex.
CARBIDE COATED FIBERS IN GRAPHITE-ALUMINUM COMPOSITES Progress Report, 1 Sep. 1973 - 31 Jan. 1974
Richard J. Imprescia, Leonard S. Levinson, Robert D. Reiswig, Terry C. Wallace, and Joel M. Williams Washington NASA Aug. 1975 28 p refs
(NASA Order L-75900)
(NASA-CR-2533; LA-5567-PR; PR-1) Avail: NTIS HC $3.75 CSCL 11D

The study of protective-coupling layers of refractory metal carbides on the graphite fibers prior to their incorporation into composites is presented. Such layers should be directly wettable by liquid aluminum and should act as diffusion barriers to prevent the formation of aluminum carbide. Chemical vapor deposition was used to uniformly deposit thin, smooth, continuous coats of ZrC on the carbon fibers of tows derived from both rayon and polyacrylonitrile. A wet chemical coating of the fibers, followed by high-temperature treatment, was used, and showed promise as an alternative coating method. Experiments were performed to demonstrate the ability of aluminum alloys to wet carbide surfaces. Titanium carbide, zirconium carbide and carbide-coated graphite surfaces were successfully wetted. Results indicate that initial attempts to wet surfaces of ZrC-coated carbon fibers appear successful. Author

N75-28144# Hughes Aircraft Co., Culver City, Calif.
DEVELOPMENT OF COMPOSITE CONSTRUCTIONS WITH IMPROVED RAIN EROSION RESISTANCE Final Summary Report, 1 Feb. 1973 - 31 May 1974
Boyce G. Kimmel Jul. 1974 103 p refs
(Contract N00019-73-C-0288)
(AD-A005494; HAC-P74-237) Avail: NTIS CSCL 11/4

This report describes the continued investigation of composite constructions for radomes with improved rain erosion resistance. The studies included the effect on the rain erosion resistance, as determined by whirling arm tests, of such variables as fiber angle, impact angle, matrix, reinforcement, and reinforcement configuration. Matrices evaluated included a rigid epoxy, a polysulfone and a phenoxy. Reinforcements included Nomex, Kevlar, Dacron and combinations of ECG or SCG glass with Dacron and Nomex, respectively. Much of the work involved the effect of fiber angle and impact angle on the rain erosion resistance of end-oriented Nomex/epoxy composites. The test results show that, with respect to rain erosion resistance, the multidimensional constructions are superior to the conventional glass fabric-reinforced laminated composites but inferior to the unidirectionally-reinforced, end-oriented composites. GRA

N75-28145# Connecticut Univ., Storrs.
A STUDY OF THE FATIGUE BEHAVIOR OF FIBER REINFORCED COMPOSITES Final Report, 1 Jul. 1973 - 31 Jul. 1974
A. T. DiBenedetto, Gideon Salee, and Robert Hlavacek Oct. 1974 62 p refs
(Contract DAAG46-73-C-0226; DA Proj. 1T0-61102-B-32A)
(AD-A005562; AMMRC-CTR-74-63) Avail: NTIS CSCL 11/4

A phenomenological model combining a Weibull distribution function with a kinetic equation for flaw growth was used to describe the static tensile strengths and fatigue lives of short graphite fiber reinforced nylon 66 sheet materials. An electrical resistivity technique was developed to measure the rate of flaw growth and scanning electron microscope studies were made in order to catalog differences in the fracture surfaces of short-lived and long-lived structures. Scanning electron microscope studies showed that specimens with a short fatigue life have glassy, fibrillated fracture surfaces while specimens with a long fatigue life exhibit a high degree of ductility in portions of the fracture surface. These differences are traced to differences in the size and shape of flaws. GRA

N75-28146# Naval Air Development Center, Warminster, Pa. Air Vehicle Technology Dept.
VISCOELASTIC CREEP AND RELAXATION IN LAMINATED COMPOSITES Final Report
Edward B. Schwartz and Edward J. McQuillen 4 Nov. 1974 145 p refs
(AD-A004958; NADC-74196) Avail: NTIS CSCL 11/4

An extensive series of creep tests were made on bulk epoxy specimens (Narmco 1004) and on three types of laminated specimens made from a composite (Modmor II 5206) with this epoxy as its matrix. Tests were made at a wide range of temperatures and stresses. The resulting laminate creep curves were compared with calculations employing a modified version of a computer program developed in connection with earlier work on this project. An equation was developed that describes the epoxy as a thermorheologically simple substance, for use in nonisothermal viscoelastic calculations. The computer program was extended to perform such calculations and used to compute the stresses in a balanced laminate assembled at 300F and cooled to 64F. GRA

N75-28147# Brush Wellman, Inc., Elmore, Ohio.
PRODUCTION ENGINEERING MEASURES TO MANUFACTURE SUPER FINE FINISH BERYLLIA Quarterly Progress Report, 1 Oct. - 31 Dec. 1974
Glenn H. Rees 29 Jan. 1975 26 p
(Contract DAAB07-74-C-0606)
(AD-A005270; BW-TR-557; QPR-2) Avail: NTIS CSCL 11/2

Surface finishes of four microinches and smoother have been attained by polishing standard Thermalox 995 for substrates and modification thereof with three micron diamond paste. A range of polishing pressures and times have been found acceptable. The input beryllia ceramic surfaces may be previously polished or as fired. GRA

N75-28148# Aerospace Corp., El Segundo, Calif.
A POLYAXIAL STRESS-STRAIN LAW FOR ATJS GRAPHITE Interim Report
Samuel B. Batdorf 28 Jan. 1975 31 p refs
(Contract F04701-74-C-0075)
(AD-A005633; TR-0075(5450-76)-2; SAMSO-TR-75-39) Avail: NTIS CSCL 11/2

Theoretical considerations are applied to Jortner's experimental data in order to develop a simple analytical stress-strain relation for ATJS under arbitrary loading conditions. Since correlation with the entire range of proportional loading data is good, it is reasonable to expect that the theoretical predictions of strains for stresses that are inaccessible in the laboratory will also be good. It is anticipated that, with minor changes in the values of the theoretical parameters, the stress-strain law will also apply to other transversely isotropic graphites. GRA

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*

N75-28149 British Library Lending Div., Boston Spa (England).
A STATISTICAL METHOD FOR COMPARING EXPERIMENTAL DATA ON THE VISCOSITY OF FREONS
Z. I. Geller, R. K. Nikulshin, and N. I. Pyatnitskaya 25 Jul. 1974 7 p refs Transl. into ENGLISH from Tr. Vses. Nauchn. Tekhn. Konf. Sb. Dokl. Sekts. (USSR), 1969 p 222-225 In ENGLISH and RUSSIAN
(BLL-NEL-TT-2594-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Data on the viscosity of liquid freons were statistically evaluated by using the following distributions: an r-distribution which characterizes the internal homogeneity of a single sample; a variant of the r-distribution known as the criterion of binary correlation; an r sub xy-distribution which characterizes the closeness of the correlation between quantities x and y; an F-criterion (F-distribution) or Fisher criterion, which characterizes the homogeneity of two different samples; and a G-criterion (G-distribution) or Cochrane criterion which characterizes the homogeneity of several samples. M.J.S.

N75-28150 Houston Univ., Tex.
NONLINEAR FEEDBACK CONTROL OF UNSTABLE PROCESSES Ph.D. Thesis
Duane Dean Bruns 1974 304 p
Avail: Univ. Microfilms Order No. 75-13941

A control policy for process operation near an unstable steady state was proposed and developed. The control strategy employs a nonlinear feedback controller with hysteresis which leads to a stable small amplitude oscillation in the neighborhood of the unstable steady state. This technique requires relatively small changes in the control parameter, thus avoiding the physical constraints sometimes faced with the conventional approach. A mathematical framework was developed to design the relay and to obtain quantitative estimates of the oscillation's characteristics and stability. The procedure requires process linearization about the unstable steady state. Describing function (DF) theory or Tsypkin's method were employed to analyze the resulting nonlinear feedback control system. While DF theory provides an approximate analysis for general control nonlinearities, Tsypkin's technique is an exact method restricted to the class of relay nonlinearities.
Dissert. Abstr.

N75-28151 California Inst. of Tech., Pasadena.
THEORETICAL STUDIES OF ELECTRONICALLY ADIABATIC AND NON-ADIABATIC CHEMICAL REACTION DYNAMICS Ph.D. Thesis
Joel Mark Bowman 1975 529 p
Avail: Univ. Microfilms Order No. 75-12512

Several sets are presented of comparisons of semi-classical, quasi-classical, and exact quantum reactive scattering calculations for collinear chemical reactions. The possibility of modifying the standard quasi-classical method according to a quantum criterion was investigated. The systems studied are H + H2, F + H2, and F + D2, and a theoretical investigation of the semi-classical S matrix is made. Details of a quasi-classical current density analysis of the H + H2 reaction are presented and a comparison with exact quantum results is made. A direct test of two versions of the vibrationally adiabatic theory of chemical reactions is made for the H + H2 reaction. The adiabaticity of the symmetric stretch motion of the H3 transition state is focussed upon. The theory of electronically non-adiabatic chemical reactions is presented and quantum calculations of the collinear H(+) + H2 yields H2 + H(+) reaction are described. A model and a realistic potential energy surface were employed in these calculations. Dissert. Abstr.

N75-28152 Texas A&M Univ., College Station.
NOVEL TECHNIQUES IN CHARGED PARTICLE ACTIVATION ANALYSIS Ph.D. Thesis
John Robert McGinley 1974 144 p
Avail: Univ. Microfilms Order No. 75-15042

Two techniques were studied with the objective of expanding the scope of charged particle activation analysis for low medium, and high Z elements: 'quasi-prompt' counting of high energy beta particles; detection of X-rays emitted during nuclear decay. A rapid, sensitive, nondestructive technique for the analysis of Li, B, C, S and Si was developed utilizing proton and deuteron reaction products. The experimental set-up developed for 'quasi-prompt' activation analysis included a sensitive and selective high energy beta-particle detector system and a method of obtaining short bursts of high energy charged particles on target. The possibility of nondispersive X-ray counting following charged particle activation was studied as a means of multielement, nondestructive trace analysis of medium and high Z elements (Z greater than 26). An evaluation was made of different types of nondispersive X-ray detectors. Thick target yields and interference-free detection limits are presented for the proton and deuteron activation products of 38 elements. Dissert. Abstr.

N75-28153 Louisiana State Univ. and A&M Coll., Baton Rouge.
A STUDY OF THE APPLICATIONS OF LASER INDUCED FLUORESCENCE IN ANALYTICAL CHEMISTRY Ph.D. Thesis
Nobuki Katayama 1974 154 p
Avail: Univ. Microfilms Order No. 75-14261

Infrared fluorescence was induced from ethylene, propylene, 1-butene, ethyl ether, acetaldehyde, methyl alcohol and ethyl alcohol with a CO2 laser radiating at 10.6 microns. A study was conducted to investigate the interference of numerous compounds on the fluorescence of ethylene at 10.6 microns. An interference to the intensity of the ethylene fluorescence signals was effected by most of these compounds when studied in evacuated systems. It was found that compounds which absorbed 10.6 micron radiation enhanced the fluorescence signal of ethylene. The quenching efficiency of the compounds on excited ethylene molecules was determined, and compared to values calculated from published data. It was determined that excited ethylene molecules could transfer vibrational energy to collision partners generating sensitized fluorescence from the latter molecules. It was also observed that the lifetime of an excited state molecule is a key factor in the application of fluorescence to air pollution monitoring. Dissert. Abstr.

N75-28154 Louisiana State Univ. and A&M Coll., Baton Rouge.
LASER INDUCED REACTIONS OF PROPYLENE AND A STUDY OF THE FEASIBILITY OF THE DETERMINATION OF SULFURIC ACID AEROSOL BY LASER INDUCED INFRARED EMISSION Ph.D. Thesis
William Morris Reid 1974 158 p
Avail: Univ. Microfilms Order No. 75-14279

Studies involving the analytical potential of laser induced infrared fluorescence for determining the concentrations of various air pollutants were conducted. Studies of the reaction of propylene with oxygen were conducted with oxygen concentrations of zero, ten, and thirty volume percent and at laser powers of 20 and 35 watts. The products were characterized by a gas chromatograph - mass spectrometer technique. The results indicated that the reaction was dependent on both oxygen concentration and laser power, with the extent of reaction increasing with increasing oxygen concentration and increased laser power. Focusing of a CO2 laser beam into sulfuric acid aerosol resulted in characteristic infrared emission from the excited sulfuric acid. A characteristic emission band centered at 6.27 microns was monitored, under optimum experimental condtions, and sensitivity data were calculated. The method, as applied with available equipment, was judged to have too little sensitivity for exhaust monitoring, but it was concluded that the method is feasible. Dissert. Abstr.

N75-28155 Illinois Univ., Urbana.
OSCILLATIONS IN AN ISOTHERMAL CONTINUOUS-FLOW, STIRRED REACTOR Ph.D. Thesis
Kenneth Richard Graziani 1975 282 p
Avail: Univ. Microfilms Order No. 75-14115

The oscillatory dynamics of the Belousov-Zhabotinskii reaction are considered. A homogeneous, isothermal, continuous-flow stirred tank reactor was employed in the experimental investiga-

tion. The behavior of the reacting system was examined as a function of various parameters, most intensively, the total feed flow rate. For relatively high and low flow rates, stable, nonoscillatory steady states were observed. For an intermediate range of flow rates, self-sustained, undamped, steady oscillations were seen to exist. Of particular interest was the observation of an abrupt, discontinuous disappearance of the steady oscillatory states upon increasing flow rate. Such phenomena suggested a region of multiplicity where both stable nonoscillatory steady states and steady oscillations coexist. A theoretical model was developed simulating the experimental reactor system with the objective of describing qualitatively the observed experimental features. Dissert. Abstr.

N75-28156 Houston Univ., Tex.
EXPLORATION OF INTERMOLECULAR EFFECTS IN LIQUIDS BY INFRARED SPECTROSCOPY Ph.D. Thesis
Stanley Curtice 1974 447 p
Avail: Univ. Microfilms Order No. 75-13942

Intermolecular effects in liquids, field potential, and decay of rotation, were explored by means of infrared spectroscopy. The shift and broadening of the C=C stretching band of cispentene-2 were studied from 473 K to 104 K, covering the liquid from the critical point to the triple point, and some measurements in the solid. Pure cis-pentent-2 and in solution with four different solvents: n-pentane, toluene, diethyl ether, and acetonitrile, were studied. The shift in the vibrational frequency was related to the second derivative of the intermolecular function by a mathematical model, and used to obtain the field potential, zU/k as a function of density, and the parameters in a potential function. The vibrational-rotational band width was related to the rotational energy of the molecule. It was found that the rotational energy of cis-pentene in all five systems studied decayed as a function of the density, decreasing to approximately 10% of its fully developed value at the triple point.
Dissert. Abstr.

N75-28157*# Old Dominion Univ. Research Foundation, Norfolk, Va.
PRE-RESONANCE RAMAN SPECTRA OF SOME SIMPLE GASES Final Technical Report
Pauline W. Low Mar. 1974 48 p refs
(Grant NGR-47-003-049)
(NASA-CR-143255) Avail: NTIS HC $3.75 CSCL 07D

The pre-resonance Raman spectra of SO2, N2O, and H2S were investigated using the 4880 A, 4727 A, and 4579 A lines of the argon ion laser. Although these molecules have electronic absorption bands in the near ultraviolet, none exhibit any pre-resonance enhancement within our experimental error of + or - 10%. Possible explanations taking into account the current theories for resonance Raman are discussed. Author

N75-28158# Materials Research Labs., Maribyrnong (Australia).
AN INLET SYSTEM FOR VOLATILE LIQUIDS FOR A GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS) SYSTEM
A. J. Power Jan. 1975 8 p refs
(MRL-TN-361) Avail: NTIS HC $3.25

A simple inlet system is described for the introduction of volatile liquids into the mass spectrometer of the Varian MAT III GC/MS System. The inlet incorporates a surge tank, fitted in place of the GC column, which absorbs the sharp pressure increase generated on injection of the sample. Author

N75-28159*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LABORATORY PROCEDURES MANUAL FOR THE FIREFLY LUCIFERASE ASSAY FOR ADENOSINE TRIPHOSPHATE (ATP)
Emmett W. Chappelle, G. L. Picciolo, C. A. Curtis, E. A. Knust, D. A. Nibley, and R. B. Vance Jan. 1975 125 p refs
(NASA-TM-X-70926; X-726-75-1) Avail: NTIS HC $5.25 CSCL 07C

A manual on the procedures and instruments developed for the adenosine triphosphate (ATP) luciferase assay is presented. Data cover, laboratory maintenance, maintenance of bacterial cultures, bacteria measurement, reagents, luciferase procedures, and determination of microbal susceptibility to antibiotics.
E.H.W.

N75-28160*# Rensselaer Polytechnic Inst., Troy, N.Y.
A NONLINEAR MODEL FOR GAS CHROMATOGRAPH SYSTEMS
Martin P. Feinberg Jun. 1975 56 p refs
(Grant NGL-33-018-091)
(NASA-CR-143209; RPI-TR-MP-47) Avail: NTIS HC $4.25 CSCL 07D

Fundamental engineering design techniques and concepts were studied for the optimization of a gas chromatograph-mass spectrometer chemical analysis system suitable for use on an unmanned, Martian roving vehicle. Previously developed mathematical models of the gas chromatograph are found to be inadequate for predicting peak heights and spreading for some experimental conditions and chemical systems. A modification to the existing equilibrium adsorption model is required; the Langmuir isotherm replaces the linear isotherm. The numerical technique of Crank-Nicolson was studied for use with the linear isotherm to determine the utility of the method. Modifications are made to the method eliminate uncessary calculations which result in an overall reduction of the computation time of about 42 percent. The Langmuir isotherm is considered which takes into account the composition-dependent effects on the thermodynamic parameter, mRo. Author

N75-28161*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
POSSIBLE APPLICATION OF LASER ISOTOPE SEPARATION
Leon M. Delionback May 1975 14 p refs
(NASA-TM-X-64947) Avail: NTIS HC $3.25 CSCL 07D

The laser isotope separation process is described and its special economic features discussed. These features are its low cost electric power operation, capital investment costs, and the costs of process materials. Author

N75-28162# Technische Universitaet, Munich (West Germany).
ELECTROCHEMICAL SYNTHESIS OF HETEROCYCLIC SYSTEMS Ph.D. Thesis [ELEKTROCHEMISCHE DARSTELLUNG HETEROCYCLISCHER SYSTEME]
Bernhard Becker 28 Oct. 1974 108 p refs In GERMAN
Avail: NTIS HC $5.25

The electrochemical cyclization of isobutyraledehyde to trioxane- and dioxane-rings as well as the trimerization of acetonitrile by the use of strongly nucleophilic anions are reported. Transl. by G.G.

N75-28163# Technische Universitaet, Munich (West Germany).
ELECTROCHEMICAL STUDIES ON THE KINETICS OF GLOSSY ZINC PRECIPITATION FROM ALKALINE CYANIDIC AND ACID ELECTROLYTES Ph.D. Thesis [ELEKTROCHEMISCHE UNTERSUCHUNGEN ZUR KINETIK DER GLANZZINKABSCHEIDUNG AUS ALKALISCH-CYANIDISCHEN UND SAUREN ELEKTROLYTEN]
Wolfgang M. Krienke 20 Feb. 1974 84 p refs In GERMAN
Avail: NTIS HC $4.75

Current density/potential curves, impedance measurements and double impulse measurements on stationary electrodes and rotating disk electrodes are used to develop kinetic data for high polish galvanization. Measurements indicate a coupled activation and inhibition mechanism where the activator levels surface roughness and the inhibitor determines fine grain quality of the deposit. Transl. by G.G.

N75-28164*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INTERFERENCE OF OXYGEN, CARBON DIOXIDE, AND WATER VAPOR ON THE ANALYSIS FOR OXIDES OF NITROGEN BY CHEMILUMINESCENCE
Howard G. Maahs Washington Aug. 1975 20 p refs
(NASA-TM-X-3229; L-10133) Avail: NTIS HC $3.25 CSCL 07D

The interference of small concentrations (less than 4 percent by volume) of oxygen, carbon dioxide, and water vapor on the analysis for oxides of nitrogen by chemiluminescence was measured. The sample gas consisted primarily of nitrogen, with

less than 100 parts per million concentration of nitric oxide, and with small concentrations of oxygen, carbon dioxide, and water vapor added. Results obtained under these conditions indicate that although oxygen does not measurably affect the analysis for nitric oxide, the presence of carbon dioxide and water vapor causes the indicated nitric oxide concentration to be too low. An interference factor - defined as the percentage change in indicated nitric oxide concentration (relative to the true nitric oxide concentration) divided by the percent interfering gas present - was determined for carbon dioxide to be -0.60 + or - 0.04 and for water vapor to be -2.1 + or - 0.3. Author

N75-28165*# Techtran Corp., Glen Burnie, Md.
DIFFERENTIAL DETECTORS FOR GAS CHROMATOGRAPHY
V. V. Brazhnikov Washington NASA Nov. 1974 214 p refs Transl. into ENGLISH from the book "Differentsial'nye Detektory dlya Gazovoy Khromatografii" Moscow, Nauka Press, 1974 p 1-223
(Contract NASw-2485)
(NASA-TT-F-15672) Avail: NTIS HC $7.25 CSCL 07D

The development of detecting systems in gas chromatography is discussed. Detector characteristics and methods of calibrating them are analyzed in detail. Means are indicated for the treatment of the chromatographic information proceeding from the detector, and the accuracy of the chromatographic analysis is shown. Author

N75-28166# Naval Ordnance Station, Indian Head, Md.
CLASSIFICATION OF OXIDIZERS AND FLAMMABLE SOLIDS, PHASE 3 Final Report
Charles B. Dale Mar. 1975 24 p refs .
(Contract DOT-AS-30042)
(PB-240878/9; DOT-TES-20-75-2) Avail: NTIS HC $3.75 CSCL 14B

Existing bench-scale test methods for oxidizers and flammable solids were critically evaluated for reproducibility and ease of duplication. Detailed drawings for the burning rate test and time-to-ignition test were submitted to permit the construction of standard test devices for uniform application. Variables which can affect measured test results were identified and recommendations were made to preclude obtaining a wide range of test values when measured by different laboratories. GRA

N75-28167# Frankford Arsenal, Philadelphia, Pa.
THERMAL AND STABILITY STUDY OF TETRACENE USING DIFFERENTIAL SCANNING CALORIMETRY (DSC) Technical Test Report
George Norwitz, Martin E. Everett, and Michael T. Gurbarg Dec. 1974 17 p refs
(AD-A005163; FA-TT-74038) Avail: NTIS CSCL 07/3

A thermal analysis study was made of tetracene (1-(5'-amino)-4-tetrazolyltetrazene hydrate) using differential scanning calorimetry (DSC). The effect of different scan speeds was investigated. A stability test for tetracene is proposed. Two lots of tetracene made by different processes showed marked differences in stability characteristics. GRA

N75-28168# Army Chemical Center, Edgewood, Md.
ON-LINE COLORIMETRIC ANALYSES USING A PROGRAMMABLE CALCULATOR Technical Report, Jun. - Oct. 1974
Howard M. Berlin and Doyle B. Stroup Feb. 1975 26 p
(DA Proj. 1W7-62710-A-095)
(AD-A005614; ED-TR-74091) Avail: NTIS CSCL 07/4

A measurement and data processing system using a programmable calculator has been developed and tested for colorimetric analyses. On-line determinations were made on the basis of the transmittance or optical density of test samples, and the results are in very good agreement with those determined from simultaneous analog recbrder readings. GRA

N75-28169# Chicago Univ., Ill. Div. of Physical Sciences.
SURFACE STUDIES Semiannual Technical Report, 1 Jun. 1974 - 31 May 1975
H. Fritzsche 31 May 1975 28 p refs
(Contract N00014-67-A-0285-0020; ARPA Order 2793)
(AD-A004997) Avail: NTIS CSCL 07/4

The objective of the Surface Studies Program is (1) to elucidate the interactions causing atoms and molecules to bind to metal surfaces and (2) to study the dynamics of gas-solid interactions on an atomic scale, and with an accuracy which has not been possible heretofore. The research program includes absorption studies, field emission spectroscopy, direct electron micrographic observation of adsorption and diffusion, dynamics of atom and molecule collisions with surface, physical and chemical processes near metal surfaces in high electric fields, and theoretical studies. Technical progress is also reported on the Leed-Auger-UPS-Esco-EID machine, extended range field emission spectroscopy, direct electron micrographic observation of adsorption and diffusion, and universal solid-gas molecular beam apparatus. GRA

N75-28170# National Environmental Research Center, Las Vegas, Nev. Technical Support Lab.
HANDBOOK OF RADIOCHEMICAL ANALYTICAL METHODS Environmental Monitoring Series
Frederick B. Johns Feb. 1975 149 p refs
(PB-240621/3; EPA-650/4-75-001) Avail: NTIS HC $5.75 CSCL 07E

A compilation is presented of the chemical procedures used at the National Environmental Research Center-Las Vegas for determining stable elements and radionuclides in environmental surveillance samples. The procedures in the current compilation are intended for use in processing relatively large number of samples in the shortest possible time for environmental radiological surveillance and, therefore, in some cases represent a compromise between precise analytical determination and adequate determination for surveillance purposes. Methods for radiostrontium in milk are included. GRA

N75-28171# Argonne National Lab., Ill.
FINE DEFINITION OF IR SPECTRA FROM HIGH TEMPERATURE INTERACTIONS OF U AND O2 Final Report, 1 Jul. 1973 - 30 Jun. 1974
S. D. Gabelnick and G. T. Reedy 25 Nov. 1974 20 p refs
(DNA Proj. NWED-QAXH)
(AD-A005433; DNA-3410F) Avail: NTIS CSCL 07/4

The basic objective was to obtain the mid-infrared spectra of ionized species resulting from the interaction of U + O2. The peaks observed in the 770-900/cm region resulting from the codeposition of UO2 and UO with NO2 in Ar matrices previously have not been reported. Normal coordinate calculations show that the observed frequencies may be attributed to a species containing one uranium atom and two oxygen atoms which is either completely isolated or loosely complexed. Although neutral complexes are known to exist when metal halides are deposited in argon matrices doped with small molecules, the presence of two peaks at 1,244 and 1,182/cm, where NO 2(+) charge-transfer bands occur, suggest that the observed bands might be attributed to free UO 2(+) or UO 2(+) charge-transfer complexes with NO 2(-). The results suggest that matrix-isolation spectroscopy may be used to study the infrared spectra of cations or cation-complexes. GRA

N75-28172# Bureau of Mines, Rolla, Mo. Metallurgy Research Center.
METHANE IGNITION BY FRICTIONAL IMPACT BETWEEN ALUMINUM ALLOYS AND RUSTED STEEL Report of Investigations
D. H. Desy, L. A. Neumeier, and J. S. Risbeck Jan. 1975 36 p refs
(PB-240838/3; BM-RI-8005) Avail: NTIS HC $3.75 CSCL 13L

Research was conducted on ignition of methane by frictional sparks from aluminum alloys impacting rusty steel at typical coal mine fan speeds. Objectives were to establish incendivity of different commercial and experimental aluminum alloys and to evaluate several substitute materials for the aluminum-steel combination. All aluminum alloys produced some ignitions in a specially designed impact apparatus. Harder experimental alloys and those containing silicon tended to be more incendive than others. With normal experimental conditions, steels, brass, and plastic did not ignite methane-air when impacted on rusty steel. Constructional steel at high speed in oxygen-enriched atmosphere caused some ignitions. It is suggested that materials

other than the aluminum-steel combination would minimize the hazard. GRA

N75-28173# National Bureau of Standards, Washington, D.C. Center for Fire Research.
MEASUREMENTS OF THE BEHAVIOR OF INCIDENTAL FIRES IN A COMPARTMENT Interim Report, Jul. 1972 - Feb. 1973
J. B. Fang Mar. 1975 30 p refs Sponsored in part by HUD (COM-75-10419/0; NBSIR-75-679) Avail: NTIS CSCL 13L

A variety of upholstered chairs and wood cribs were burned within a ventilated compartment. The experimental measurements of weight loss, smoke concentration, temperature and heat flux levels are summarized. A reproducible fire obtained from burning a standardized wood crib array was found to be capable of representing the essential features of incidental fires of moderate intensity. GRA

N75-28174# Army Natick Labs., Mass. Clothing Equipment and Materials Engineering Lab.
THE DESIGN AND SYNTHESIS OF INFRARED FLUORESCENT COLORANTS
A. Zweig and G. W. Nachtigall Nov. 1974 57 p refs
(Contract DAAG17-73-C-0203; DA Proj. 1T7-62713-DJ-40) (AD-A005082; USA-NLABS-TR-75-30-CEMEL; CE/MEL-134) Avail: NTIS CSCL 07/3

A full spectral examination revealed that the total fluorescence emission from Direct Blue 108, a commercial dioxazine dye with moderate near infrared fluorescence, is much greater than that from Basic Blue 3, the strongest near infrared fluorescer uncovered in a Natick investigation of commercial dyes. Molecular orbital calculations performed on twenty-one related dioxazine structures indicate that a ring system with two perylene moieties fused to the dioxazine system, should fluoresce near 750 nm when dyed on nylon. These calculations, coupled with literature reports of high fluorescence yield for perylene derivatives, incidate that this ring system is likely to fulfill the Natick Laboratories: requirements. Ongoing efforts to synthesize nylon dyes containing the desired ring system are discussed. A total of 16 new compounds prepared during the course of this effort are described and characterized. A reliable method of preparing the essential intermediate, 3-aminoperylene, (3-AMP) from commercially available starting materials in good yields was developed. GRA

N75-28175# Army Materials and Mechanics Research Center, Watertown, Mass.
COMPUTER PROGRAMS FOR QUANTITY DETERMINATION IN NEUTRON ACTIVATION ANALYSIS Final Report
John J. Antal and Albert A. Warnas Dec. 1974 72 p refs (DA Proj. 1T1-61102-B-32A)
(AD-A005218; AMMRC-TR-74-33) Avail: NTIS CSCL 07/4

This report describes and lists several programs written in PAL III assembly language for the PDP-8 series of minicomputers to compute the quantity of an unknown element as determined by the AMMRC 14-MeV neutron activation analysis system. A complete determination of the error in the quantity of the unknown element is made in the program and is described here. GRA

N75-28176# Army Foreign Science and Technology Center, Charlottesville, Va.
ELECTRODE REACTIONS OF THE HYDRAZONIUM ION ON PLATINIZED PLATINUM
T. N. Glazatova and G. V. Vitvitskaya 26 Aug. 1974 11 p refs Transl. into ENGLISH from Vses. Nauch. Issled. Akkumuliatornyi Inst. Sbornik Rabot po Khim. Istochnikam Toka (USSR), no. 7, 1972 p 189-193
(AD-A005208; FSTC-HT-23-1001-74) Avail: NTIS CSCL 07/4

The kinetics of the cathode reaction and the nature of the equilibrium potential of a platinized platinum electrode at 20 C were examined in solutions of hydrazine in H3P04, by equilibrium polarization measurements. It was shown that, with increase in temperature from 20 C to 60 C, together with the electrochemical oxidation N2H5(+) and reduction H(+) reactions on Pt, catalytic decomposition of hydrazone begins. A composite scheme of the electrode process on Pt, under test conditions, is presented. Author

N75-28177# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
TEMPERATURE DEPENDENCE OF THE ESR SPECTRUM OF NiSnCl6.6H2O
Y. Ajiro, Simeon A. Friedberg, and Ned S. VanderVen 30 Dec. 1974 37 p refs
(Contract N00014-67-A-0314-0006; NR Proj. 018-301)
(AD-A005003; TR-13) Avail: NTIS CSCL 07/4

The electron spin resonance spectrum of single-crystal NiSnCl6-6H2O has been measured at X-band at temperatures between 4.2 and 370 K. The results are consistent with low-temperature magnetic and thermal measurements that indicate a singlet ground state for the Ni(H2O)6(2+) complex. Linewidth measurements below 300 K indicate contributions from spin-lattice relaxation and from both isotropic and anisotropic exchange. Linewidth measurements in the vicinity of D = 0 exhibit narrowing due to vanishing of the isotropic exchange contribution and broadening by cross-relaxation. GRA

N75-28178# Army Foreign Science and Technology Center, Charlottesville, Va.
COMBUSTION OF TWO-PHASE MIXTURES
S. K. Aslanov 4 Oct. 1974 21 p refs Transl. into ENGLISH from Arch. Procesow Spalania (USSR), v. 3, no. 2, 1972 p 165-177
(AD-A005067; FSTC-HT-23-17-75) Avail: NTIS CSCL 21/2

A study was made of the gas-dynamic stability of the propagation of detonation in an aerosol and the combustion of a solid fuel with respect to one-dimensional perturbations of the exponential type. The internal structure of the processes studied is centrally considered, and from an analysis of the mechanical interaction of the structure with spontaneous perturbations, feedback equations are derived for each case. The system of boundary conditions controlling the perturbed states of processes is based on the successful application to the zones of their occurrence of fundamental theorems of hydrodynamics concerning change in mass, in momentum, and in energy. As a result, analytic criteria of instability are found, delimiting the region of the possible existence of steady-state regimes of the processes being analyzed and indicating ways of stabilizing the pulsations that arise. GRA

N75-28179# Army Foreign Science and Technology Center, Charlottesville, Va.
EFFECT OF IONIZING RADIATION ON COMBUSTION OF AMMONIUM PERCHLORATE AND MIXTURE SYSTEMS OF THE LATTER
V. A. Strunin, G. B. Manelis, A. N. Ponomarev, and V. L. Talroze 4 Oct. 1974 15 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Fiz. Inst., 1969 p 1-9
(AD-A005066; FSTC-HT-23-860-74) Avail: NTIS CSCL 21/2

Ammonium perchlorate and mixtures of it were studied for the effect of ionizing radiation. Various types of ionizing radiation showed the effect on the combustion of ammonium perchlorate of different pressures and temperatures. The results obtained agreed with the theories held on the role of processes taking place in the condensed zone and on determining the combustion rate. GRA

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N75-28180 British Library Lending Div., Boston Spa (England).
STRESS CORROSION AND STAINLESS STEEL IN THE MANUFACTURE OF BOILERS OPERATING UNDER PRESSURE AND AT HIGH TEMPERATURE
R. Teraube Nov. 1973 14 p Transl. into ENGLISH from Mater. Tech. (France), 1972 p 232-236 In ENGLISH and FRENCH
(BLL-BTI-746-1487-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The nature of the problem posed by stress corrosion phenomena to the boiler manufacturer and the user of the boilers is discussed. Topics discussed include crack formation, fatigue

cracks, loop or autoclave tests, electrochemistry, and methods for studying stress corrosion phenomena. M.J.S.

N75-28181 British Library Lending Div., Boston Spa (England).
APPLICATION OF ELECTRON MICROSCOPIC MICROANALYSIS IN METALLOGRAPHY
H. B. Zeedijk Dec. 1973 11 p refs Transl. into ENGLISH from Materialpruefung (Duesseldorf), v. 15, no. 6, 1973 p 213-217 In ENGLISH and GERMAN
(BLL-LTI-746-1492-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Electron microscopic microanalysis of transmission specimens is compared with electron beam microanalysis with the microprobe or the scanning electron microscope. The morphology, crystalline structure and composition at the same point in the specimen is determined with this technique. When replicas are used as specimens, particles with a smaller diameter than that of the electron beam are analyzed, since interference effects from the matrix are cut out during analysis. Examples of electron microscopic microanalysis of carbides, other types of precipitates, corrosion products, and inclusions are described. Author

N75-28182 British Library Lending Div., Boston Spa (England).
EVALUATION OF THE INFLUENCE OF THE ELECTROLYTE CONSTITUENTS ON THE POLARISATION OF NICKEL ANODES
G. Prassler Dec. 1973 12 p refs Transl. into ENGLISH from Neue Huette (Leipzig), v. 18, no. 6, 1973 p 342-346 In ENGLISH and GERMAN
(BLL-LTI-746-1496-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

To study the electrolytic dissolution behavior of nickel anodes, particularly depolarized anodes, the development of a nickel-ion-free model electrolyte was investigated. The influence of the constituents of a Watts electrolyte on the polarization of nickel anodes was studied, and it was shown that no model electrolyte could exactly reproduce the real polarization and dissolution behavior. The differences in polarization of the materials used were reproduced in the correct proportion, so that electrolyte 16 may be used for investigations of the anodic properties of nickel materials. Author

N75-28183 British Library Lending Div., Boston Spa (England).
THE EFFECT OF HYDROSTATIC PRESSURE ON COMPONENTS OF THE YIELD POINT OF COBALT STEEL 10 KP
M. I. Kalachev and V. M. Leshchinskii 10 May 1974 6 p refs Transl. into ENGLISH from Vestn. Akad. Nauk Belaruskii SSR (USSR), v. 3, 1973 p 9-11
(BLL-NEL-TT-2566-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The components of the yield point of cobalt steel were studied as the metal was subjected to stretching with the application of compressive stresses. Results show that for a fixed rate of deformation there is a fully defined relation of hydrostatic pressure and temperature, at which the maximum hardening of a dynamically aging metal takes place as a result of the development of dislocation blocking processes and the precipitation of finely dispersed particles. The action of normal compressive stresses on the process of plastic flow in a dynamically aging metal lies in the increase in the diffusivity of alloy atoms and the intensification of the interaction between the dislocations and the Cottrell atmospheres. This ultimately leads to more intense formation of finely dispersed particles at the dislocations and to a sharp increase in the obstacles to their movement. Author

N75-28184 British Library Lending Div., Boston Spa (England).
FINE POLYCOMPONENT CARBONYL IRON-NICKEL POWDERS
N. A. Belozerskii, L. D. Segal, and R. L. Meltser 14 May 1974 12 p refs Transl. into ENGLISH from Poluch., Svoistva Primen. Tonkikh Metal. Porosh., Dokl. (USSR), 1970 p 63-69 In ENGLISH and RUSSIAN
(BLL-LTI-746-1455-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A method for the production of carbonyl iron-nickel powders was developed for introduction on an industrial scale. This method is based on the combined thermal decomposition of a solution of the carbonyls of nickel and iron, which are mixed with each other in any proportions. The scheme for producing iron-nickel powders is presented which is comprised of the following: nickel tetracarbonyl and iron pentacarbonyl pass from a hopper through measuring vessels into a tank with mechanical stirring. From here the carbonyl mixture is poured into a service tank, and, using a fluid pump, are fed directly to the atomizer via a system of filters. Using a hydrostatic pressure of 1-4atm, created by the fluid pump, the liquid mixture is atomized into a very fine spray, and in this form it is introduced into the heating zone of the decomposer. Fine atomization ensures and accelerates vaporization of the carbonyl mixture. Author

N75-28185 British Library Lending Div., Boston Spa (England).
CARBIDE PHASES NICKEL-BASED HEAT-RESISTANT ALLOYS
G. D. Pigrova and E. E. Levin 14 May 1974 11 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (Moscow), v. 33, no. 6, 1972 p 1297-1301
(BLL-LTI-746-1427-(9022.401)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The composition, structure and quantity were investigated of carbide phases, produced during the process of long-term ageing at 700-1000 C, in nickel-based alloys. The concentrations of carbon in test melts of these alloys are given. The carbide phases which formed in the alloys were studied by phase analysis methods; in order to isolate the carbides, an electrolyte containing methanol was used. The type of carbide and its lattice parameter were determined by an X-ray method, and its composition and quantity were determined by chemical analysis of the resulting deposit. Since boride phases were isolated at the same time in the electrolyte which was used, a correction for the quantity of borides was performed. Author

N75-28186 British Library Lending Div., Boston Spa (England).
EFFECTS OF HEAT TREATMENT ON THE MAGNETIC PROPERTIES OF ALLOYS BASED ON RARE EARTH METALS, CONTAINING COBALT AND COPPER
B. G. Livshits, B. A. Samarin, and Dzh. V. Tsertsvadze [1974] 7 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 5, 1974 p 136-137 In ENGLISH and RUSSIAN
(BLL-M-25004-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The effects of homogenization and tempering temperature on the magnetic properties of rare earth alloys containing cobalt and copper melted in a helium atmosphere in an arc furnace were investigated. The magnetic properties were measured by the ballistic method in powders oriented in a magnetic field. Homogenization greatly smooths out the effect of the tempering temperature on the magnetic properties and raises their overall level. The best magnetic properties were obtained after specimens had been homogenized and then tempered at 400 C. Author

N75-28187 British Library Lending Div., Boston Spa (England).
PROPERTIES OF ELECTROLYTE FOR DEPOSITION OF CHROMIUM COBALT ALLOY
I. F. Ponomarenko, M. A. Shluger, and A. P. Sajmanova Jan. 1975 5 p Transl. into ENGLISH from Tekhnol. Organ. Proizvod. (Ukrainian SSR), v. 2, 1970 p 85-86
(BLL-RTS-9084) Avail: British Library Lending Div., Boston Spa, Engl.: £0.80; 1 BLL photocopy coupon

The effect of electrolyte concentration changes, during electrolysis, on the electrodeposition of chromium cobalt alloy is studied. Other parameters considered include pH, diffusion power, and electrical conductivity. Author

N75-28188 British Library Lending Div., Boston Spa (England).
RECENT DEVELOPMENTS IN TOOL STEELS
F. Hickel 10 Jun. 1974 13 p refs Transl. into ENGLISH from Werkstattstechnik (Berlin), v. 62, no. 10, 1972 p 569-593 In ENGLISH and GERMAN
(BLL-NEL-TT-2573-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Quality characteristics and criteria for steels used in toolmaking and for cutting tools are discussed. Types of steels discussed include unalloyed carbon tool steels, alloyed cold-cutting steels, and alloyed hot-cutting steels; performance characteristics of all these steels were studied. M.J.S.

N75-28189 British Library Lending Div., Boston Spa (England).
EFFECTS OF THE INITIAL STATE OF TECHNICAL PURITY MOLYBDENUM ON ITS SHORT TIME HIGH TEMPERATURE STRENGTH
I. N. Kidin, B. G. Belyakov, M. N. Kryanina, and B. V. Mochalov [1974] 11 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 3, 1974 p 135-139 In ENGLISH and RUSSIAN
(BLL-M-21967-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The short time properties of cold deformed molybdenum and molybdenum in which a polygonization structure had first been created by preliminary treatment, were studied during high speed heating. Also considered was the effect of heating rate in the region of hypo-recrystallization temperatures on dislocation structure of the initial cold deformed metal. The effect of the heating rate on short time high temperature strength of Mo only shows up during brief tests at a test temperature of 1000 C. There is a polygonization substructure in molybdenum after the preliminary heating of the cold deformed metal at rates of 1 and 10 C/s, and that this has a favorable effect with regard to increasing the short time high temperature strength.
Author

N75-28190 British Library Lending Div., Boston Spa (England).
ELASTIC MODEL OF GRAIN BOUNDARIES IN METALS
L. M. Klinger [1974] 13 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern Met. (USSR), no. 3, 1974 p 113-116
(BLL-M-21965-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A model of the grain boundary as a region of elastic distortions of the lattice that are periodic in nature is considered. The model gives applicable values of the boundary energy and its temperature dependence. The interaction of the boundary with an impurity is considered, and it was found to be of the same order as the interaction of an impurity with a dislocation.
Author

N75-28191 Delaware Univ., Newark.
MASS SPECTROMETRIC STUDIES ON INERT GAS ION SCATTERING AND SECONDARY ION EMISSION FROM COPPER Ph.D. Thesis
Luisto Lahoz Tongson 1975 106 p
Avail: Univ. Microfilms Order No. 75-14977

A combined ion scattering and secondary ion mass spectrometer, for use in studies of low energy ion bombardment of solids, is described. The principle of operation, constructional details, and capabilities are presented. The use of the instrument in secondary ion emission and ion scattering studies are discussed. The ion scattering studies examine the validity of the binary collision model between the incident He+(-4) and Ne+(-20) ions and the atom of a polycrystalline copper target for projectile ion energies of 1 kev to the threshold energies at which the energy of the scattered He+(4) and Ne+(20) ions could be measured. A calculation of the scattering cross section for the Ne-Cu system based on an energy dependent hard sphere model is made. The advantages of using a magnetic field to analyze the secondary (scattered and sputtered) ions from the target are emphasized. Unambiguous distinction between sputtered and scattered ions as to mass and energy provides a meaningful investigation of the simple binary collision approximation at very low bombarding ion energies.
Dissert. Abstr.

N75-28192 Missouri Univ., Rolla.
THE EFFECTS OF HIGH PRESSURE AND TEMPERATURE ENVIRONMENTS ON THE PROPERTIES OF 6061-T651 ALUMINUM Ph.D. Thesis
Patrick George Davidson 1974 104 p
Avail: Univ. Microfilms Order No. 75-15816

The effects of the simultaneous application of high pressure and temperature environments on the mechanical properties of 6061-T651 aluminum were analyzed. From the data obtained at the yield and ultimate points a yield and ultimate model was developed based upon the parameters effective stress, effective strain, and the hydrostatic component of stress. This model was obtained solely from the data acquired from uniaxial tensile specimen tested at various pressures and temperatures. Two other loading paths-biaxial tension and torsion-were then used to verify the accuracy of the model. Data were also obtained for the effects of the pressure and temperature environments on the other material properties such as Young's modulus, Poisson's ratio, and ductility. The third objective of this testing program was to develop test fixtures which would be able to perform the required tests as well as to operate under the extreme environmental conditions.
Dissert. Abstr.

N75-28193 Drexel Univ., Philadelphia, Pa.
FORGING OF METAL-MATRIX COMPOSITES: FORMING LIMIT CRITERIA AND APPLICATIONS TO PROCESS DESIGN Ph.D. Thesis
R. Turgay Ertuerk 1975 132 p
Avail: Univ. Microfilms Order No. 75-14402

Fundamental deformation and fracture behavior of fiber-reinforced metal-matrix composites were determined under conditions of simulated forging. Defects that occur during the forging of a sample material (2024 Al-alloy matrix reinforced with 25 v/o stainless steel wires) are characterized, and criteria for their prediction and prevention established. These forming limit criteria, in combination with an analysis of metal flow during deformation processing, were used to develop a forging process for an airfoil shape. The design method developed, based on the forming limit criteria, demonstrates a rational approach to the design of processes for forging complex shapes from composite materials. Utilizing this approach, process parameters (die and preform geometry, lubrication) can be evaluated for forging sound complex composite shapes.
Dissert. Abstr.

N75-28194 Missouri Univ., Rolla.
PREMARTENSITIC ELASTICITY OF Fe-Ni INVARS Ph.D. Thesis
Bryce Linn Shriver 1973 35 p
Avail: Univ. Microfilms Order No. 75-15852

The premartensitic temperature dependence of ultrasonic wave propagation in Fe-30 pct Ni polycrystals and Fe-32 pct Ni single crystals was measured by using a continuous wave technique. As the temperature was lowered to within 10 C of the M sub s, a nonlinear decrease of the relative shear velocity was observed. This effect is related to dislocation stacking fault instabilities which may trigger the martensitic phase transformation. In addition, the single crystals show a frequency dependence of the shear elastic constant C prime well above the M sub s. The dispersion is believed to be caused by fluctuations in the anisotropic molecular field which precede the magnetic transformation which occurs with the formation of martensite.
Dissert. Abstr.

N75-28195 Syracuse Univ., N.Y.
CRACK TIP DEFORMATION AND DUCTILE FRACTURE CRITERIA Ph.D. Thesis
Jeng Shyong Ke 1974 124 p
Avail: Univ. Microfilms Order No. 75-13998

Near tip strain is proposed as a ductile fracture criterion. This criterion was used to study the onset of slow growth of surface crack. The data from two batches, B and C, of fully annealed 2024-0 aluminum alloy and HY-80 steel substantiated the proposed criterion. The measured fracture toughness at the onset of surface crack growth is given, and it was demonstrated that the measurement can be made easily with a small foil resistance strain gage. The near tip strain criterion was compared with both crack surface opening displacement and J-integral criteria. Local deformation near a crack tip was also investigated when a cracked specimen was stressed at small scale yielding or beyond general yielding. Crack opening displacements and near tip strains were measured by the moire technique along with the gross elongation in the cracked section. These three quantities were found to be linearly related. Surface strain distributions near a crack are influenced by the local necking at the crack tip, which is controlled by the plate thickness.
Dissert. Abstr.

N75-28196 Pennsylvania Univ., Philadelphia.
DEFORMATION AND FRACTURE OF THE NICKEL-PALLADIUM-PHOSPHORUS AMORPHOUS ALLOYS Ph.D. Thesis
Shinji Takayama 1974 283 p
Avail: Univ. Microfilms Order No. 75-14630

Mechanical behavior, deformation and fracture of amorphous alloys were investigated on Ni55Pd35P10 and Ni63Pd17P20 amorphous phases which were made by an improved Pond and Maddin method. The stress-strain curves of NiPdP amorphous alloys show a quasi-brittle material behavior and the average fracture stress of Ni55Pd35P10 and Ni63Pd17P20 is 149 kg/sq mm and 142 kg/sq mm respectively. These stresses are quite high in comparison to normal metals and alloys. The elongations are small, 0.042% and 0.023% for Ni55Pd35P10 and Ni63Pd17P10 respectively as is the elongation of all amorphous alloys (also called metallic glasses). The observation of fracture surfaces made with a scanning electron microscope (S.E.M.) always shows two distinct regions, i.e., featureless and nonfeatureless parts called a vein or ridge pattern. These regions are also characteristic of metallic glasses. Dissert. Abstr.

N75-28197 Michigan Technological Univ., Houghton.
THE FRACTURE TOUGHNESS OF THIN BERYLLIUM SHEET Ph.D. Thesis
George Emil Tardiff, Jr. 1974 155 p
Avail: Univ. Microfilms Order No. 75-14390

The ambient temperature fracture toughness of a thin beryllium sheet was measured for a wide variety of metallurgical conditions. Various experiments were also carried out to develop an understanding of the factors that account for and limit the magnitude of the fracture toughness. In order to measure the fracture toughness over the widest possible range in yield-strength and fracture-toughness levels, it was necessary to develop fracture test methods for the large-scale plastic yielding regime. Three independent methods, one developed previously by others (J integral) and two new methods based on a compliance technique and a plastic work approach, were found to give equivalent results. The fracture toughness of the ingot source sheet under investigation varied from 15 to 40 MP a x m to the 1/2 power depending on the effect of heat treatment on the microstructure. The low toughnesses were associated with the presence of small subgrains in the microstructure. Dissert. Abstr.

N75-28198 Michigan Technological Univ., Houghton.
DEFORMATION, ANNEALING, AND GRAIN GROWTH IN Cu AND DILUTE CuBASE ALLOYS Ph.D. Thesis
William George Truckner 1973 196 p
Avail: Univ. Microfilms Order No. 75-14395

The deformation and annealing behavior of cold rolled Cu, Cu-0.0004at.% S, and Cu-0.0095at.% Sn was studied with X-ray diffraction. For Cu, the particle size (or cell size) decreases with increasing amounts of deformation up to approximately 60% reduction in thickness where it becomes constant at 450A. The rms microstrains increase with increasing amounts of deformation up to 80-85% reduction where a decrease occurs. Further amounts of deformation cause a continual decrease in the rms microstrains. The addition of 0.0095at.% Sn delays the onset of the decrease in the rms microstrain until 90-95% reduction. In general, dilute solute additions have a negligible effect on the substructure at intermediate deformations (75% reduction), and do not change the deformation or annealing texture of Cu. During the initial stage of annealing of Cu and Cu-0.0004at.% S the rms microstrains decrease slightly while in Cu-0.0095at.% Sn a sharp decrease occurs, the magnitude of which is temperature dependent.
Dissert. Abstr.

N75-28199 Pennsylvania Univ., Philadelphia.
THE EMBRITTLEMENT OF Ni-Cr STEELS BY PHOSPHORUS AND ANTIMONY Ph.D. Thesis
Robert Alan Mulford 1974 194 p
Avail: Univ. Microfilms Order No. 75-14601

Temper embrittlement was studied in low alloy steels (containing Ni and/or Cr) doped with P or Sb and isothermally embrittled at several temperatures. Measurements of the ductile to brittle transition temperature were made and correlated with the results of matrix hardness measurements, Auger electron spectroscopy of the grain boundary fracture surfaces, and scanning electron fractography. The results indicate that the transition temperature is influenced by the amount of the impurity which has segregated to the grain boundary, the embrittling potency of this impurity, and the matrix hardness. It was shown that if all other factors remain constant, the effect of a change in the matrix hardness can be very large. It was shown that overageing in phosphorus doped alloys is due to change in the matrix hardness and not to a reversal of the phosphorus segregation. In contrast to the results of phosphorus doped steels, segregation of Sb was found to be strongly influenced by the alloy content. Dissert. Abstr.

N75-28200 Yale Univ., New Haven, Conn.
THE INVESTIGATION OF YIELD SURFACES BY THE DISLOCATION MECHANICS Ph.D. Thesis
George Jueng-Cious Weng 1974 186 p
Avail: Univ. Microfilms Order No. 75-15397

The plastic deformation of metals due to the movement of dislocations, is discussed along with yield surfaces and their role in the study of plasticity. The kinematics of dislocations in the two-dimensional plastic deformation were examined. The classical problems in the slip-line theory, such as Hencky's two laws and Geiringer's relations are reapproached from the standpoint of dislocations. The deformation curvature, which is caused by the presence of dislocations, the lattice deformation, and the dislocation movement, was analyzed. To study the yield surfaces by the dislocation considerations, the stress fields induced by the presence and by the movement of dislocations are derived. On the basis of dislocation mechanics, a yield criterion and a new hardening law are introduced. These yield criterion and hardening law enable one to construct the initial and subsequent yield surfaces for single crystals and to determine the subsequent yield surfaces for polycrystalline aggregates. Dissert. Abstr.

N75-28201 Illinois Univ., Urbana.
A NUCLEAR MAGNETIC RESONANCE STUDY OF DILUTE COPPER-VANADIUM ALLOYS Ph.D. Thesis
David Martin Follstaedt 1975 167 p
Avail: Univ. Microfilms Order No. 75-14109

NMR is well-suited to studying the nearly insoluble vanadium atoms as the measurements are not affected by the presence of undissolved vanadium. V51, Cu63, and C65 nuclear resonances are used to obtain information on the relative amounts of dissolved and undissolved vanadium, on the magnetic nature of the dissolved vanadium atom, and on the electric field gradients produced in the host when the atom is dissolved. It is concluded that the magnetic nature of vanadium atoms in copper is similar to that of cobalt, but the electric fields are much stronger around vanadium atoms. Dissert. Abstr.

N75-28202 Maryland Univ., College Park.
CHLORINATION-VOLATILIZATION PROCESS FOR RECOVERING NICKEL, MANGANESE, AND COBALT FROM REFRACTORY NICKEL ORES Ph.D. Thesis
Earle Bartley Amey 1974 156 p
Avail: Univ. Microfilms Order No. 75-14297

A nickeliferous limonite ore and a synthetic ore, a mixture of NiO and SiO2 that did not contain iron, were chlorinated with HCl in a thermobalance and in a fluidized bed reactor. Activation energies from weight losses that were obtained by the thermobalance are 22.9 and 10.0 Kcal per mole, respectively. Apparent activation energies obtained with the fluidized bed are 10.1 Kcal per mole for the limonite ore and 2.8 Kcal per mole for the synthetic ore. Although 100 percent of the nickel and iron can be extracted from the limonite ore, these extractions can be varied to maximize the amount of nickel with a corresponding minimum amount of iron. Equations were derived to show the combination of operating parameters controlling the percent nickel and iron extracted. To compliment these studies, a mechanism is proposed that the nickel in the limonite ore is chloridized by ferric chloride rather than by the HCl.
Dissert. Abstr.

N75-28203 Illinois Univ., Urbana.
HIGH RESOLUTION LOW ENERGY ELECTRON DIFFRACTION FROM THE ALUMINUM (100) SURFACE Ph.D. Thesis
John Franklin Wendelken 1975 172 p
Avail: Univ. Microfilms Order No. 75-14188

A new high resolution low energy electron diffractometer was constructed. This apparatus was applied in a program of surface studies dealing with the electronic, vibrational, geometrical, and chemical structure of the Al(100) surface. The surface-plasmon dispersion relation was examined to provide information important

to the understanding of surface electronic properties. Measurements were made at T = 100 K and at T = 300 K. An apparent temperature dependence of the plasmon dispersion may be attributed primarily to the temperature dependence of the inelastic diffuse background. As a prerequisite to the application of a two-step model to the inelastic data, a survey of specular elastic scattering was conducted. These measurements are presented in absolute intensity units for the case T = 85 K. From this data it is possible to calculate the lattice spacing normal to the surface for the surface layer. The influence of lattice vibrational properties on electron scattering was also examined. Dissert. Abstr.

N75-28204 Ecole Nationale Superieure des Mines, Paris (France). Centre des Materiaux.
STRESS CORROSION INITIATION IN TITANIUM ALLOYS TO BE USED IN REACTORS AND AIRFRAMES Final Report [ETUDE DE L'INITIATION DE LA CORROSION SOUS TENSION DANS LES ALLIAGES DE TITANE DESTINES AUX REACTEURS ET CELLULES D'AVION]
Charles Saint-John 1 May 1974 53 p refs In FRENCH
(Contract DGRST-72-7-0343)
Avail: Issuing Activity

Surface contaminated titanium alloys were assayed for stress corrosion by electron microscope fractography. Physico-chemical methods (ionosondes, ion probing and X-ray diffraction) allowed identification of conditions for contaminated surfaces (surface compound formation and gas-solid solutions). Contamination lowers the threshold of microcrack appearance. The influence of the stress corrosion test modality was also studied. ESRO

N75-28205# Materials Research Labs., Melbourne (Australia).
FRACTURE TOUGHNESS TESTING OF METALS
M. E. DeMorton and J. C. Ritter 1975 30 p refs
Avail: NTIS HC $3.75

The present state of plane strain fracture toughness testing of metals is reviewed. The various elements in the closed loop servohydraulic testing systems developed for fracture toughness testing are discussed along with ancillary equipment for monitoring crack displacement at various temperatures and strain rates. Test specimen selection which involves size, shape, and dimensional requirements on thickness and crack length is discussed in detail. Experimental techniques and specimens used for measuring fracture toughness over a wide range of strain rates are described along with sources of data on the temperature and strain dependence of yield stress. Author

N75-28206*# Louisiana State Univ., Baton Rouge.
INELASTIC INTERACTION MEAN FREE PATH OF NEGATIVE PIONS IN TUNGSTEN
D. L. Cheshire (Louisiana State Univ., Baton Rouge), R. W. Huggett (Louisiana State Univ., Baton Rouge), W. V. Jones (Louisiana State Univ., Baton Rouge), S. P. Rountree (Louisiana State Univ., Baton Rouge), W. K. H. Schmidt (Max-Planck-Inst. fuer Extraterrestrische Physik, Munich), R. J. Kurz (TRW System, Redondo Beach, Calif.), T. Bowen (Arizona Univ., Tucson), D. A. DeLise (Arizona Univ., Tucson), E. P. Krider (Arizona Univ., Tucson), and C. D. Orth (California Univ., Berkeley, Lawrence Berkeley Lab.) [1975] 24 p refs Sponsored in part by NSF
(Contracts NAS5-11426; NAS5-11425; NAS8-27408; NAS9-10986; NAS9-11884; Grant NGR-19-001-012)
(NASA-CR-143259) Avail: NTIS HC $3.25 CSCL 11F

The inelastic interaction mean free paths lambda of 5, 10, and 15 GeV/c pions were measured by determining the distribution of first interaction locations in a modular tungsten-scintillator ionization spectrometer. In addition to commonly used interaction signatures of a few (2-5) particles in two or three consecutive modules, a chi2 distribution is used to calculate the probability that the first interaction occurred at a specific depth in the spectrometer. This latter technique seems to be more reliable than use of the simpler criteria. No significant dependence of lambda on energy was observed. In tungsten, lambda for pions is 206 plus or minus 6 g/sq cm. Author

N75-28207*# Case Western Reserve Univ., Cleveland, Ohio. School of Engineering.
DEFORMATION AND ANNEALING STUDY OF NICRALY Annual Status Report, Jul. 1974 - Jun. 1975
David M. Trela and L. J. Ebert Jun. 1975 71 p refs
(Grant NGR-36-003-094)
(NASA-CR-143207) Avail: NTIS HC $4.25 CSCL 11F

Extensive experiments were carried out on the ODS alloy Nicraly, (an alloy prepared by mechanical alloying and consolidating a powder blend consisting of 16% chromium, 4% aluminum, 2-3% yttria, balance nickel), in efforts to develop methods of controlling the grain size and grain shape of the material. The experiments fell into two general categories: variations in the annealing parameters using the as-extruded material as it was received, and various thermomechanical processing schedules (various combinations of cold work and annealing). Success was achieved in gaining grain size and grain shape control by annealing of the as-extruded material. By proper selection of annealing temperature and cooling rates, the grain size of the as-received material was increased almost two orders of magnitude (from an average grain dimension of 0.023 mm to 1.668 mm) while the aspect ratio was increased by some 50% (from 20:1 to 30:1). No success was achieved in gaining significant control of the grain size and shape of the material by thermo-mechanical processing. Author

N75-28208*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL EXPANSION IN THE NICKEL-CHROMIUM-ALUMINUM AND COBALT-CHROMIUM-ALUMINUM SYSTEMS TO 1200 DEGREES C
Carl E. Lowell, Ralph G. Garlick, and Bert Henry Washington Aug. 1975 19 p refs
(NASA-TM-X-3268; E-8323) Avail: NTIS HC $3.25 CSCL 11F

Thermal expansion data were obtained on 12 Ni-Cr-Al and 9 Co-Cr-Al alloys by high temperature X-ray diffraction. The data were computer fit to an empirical thermal expansion equation developed in the study. It is shown that the fit is excellent to good, and that the expansion constants depend on phase but not on composition. Phases for the Ni-Cr-Al system and Co-Cr-Al system are given. Results indicate that only alpha Cr has an expansion constant low enough to minimize oxide spalling or coating cracking induced by thermal expansion mismatch. Author

N75-28209*# Stanford Research Inst., Menlo Park, Calif.
ZINC-RICH COATINGS: A MARKET SURVEY
Ruth Lizak Washington NASA Aug. 1975 43 p refs
(Contract NASw-2731)
(NASA-CR-2585) Avail: NTIS HC $3.75 CSCL 11C

Zinc-rich coatings with both organic and inorganic binders were considered for coastal bridges which require more corrosion protection than inland bridges because of exposure to salt spray and fog. Inorganics give longer protection and may be applied without a finish coat; those currently available are harder to apply than organics. The NASA potassium silicate/zinc - dust coating appears to provide longer protection, resist thermal shock, and overcome the application problem. Panels coated with the formulation withstood 5308 hours in a salt spray chamber with no rusting or blistering. Author

N75-28210# Lockheed-California Co., Burbank.
FATIGUE CRACK GROWTH, ARREST, AND REINITIATION ALONG A ROW OF HOLES
T. H. Brussat 20 Dec. 1974 55 p refs
(LR-26806) Avail: NTIS HC $4.25

Fatigue crack growth along a row of fastener-sized holes in 7075-T6 aluminum sheet was investigated experimentally and analytically. The cracking sequence is punctuated by substantial periods of crack reinitiation with each arrestment at a hole. Two methods for estimating the duration of these crack reinitiation periods were developed and compared with the test data. The use of crack nucleation data and theory for such estimation appears to more closely predict test results than the use of fracture mechanics analysis with an assumed .005 in preexisting microcrack. Some formulas for stress concentration factors and stress intensity factors are presented. The discussion of the significance of the elastic stress field near a long notch is offered which may have useful implications for fatigue analysis. Author

N75-28211# Frankford Arsenal, Philadelphia, Pa.
FUSED-ON ROTATING BANDS FOR PROJECTILES
David E. Schillinger Dec. 1974 32 p refs
(DA Proj. 1T1-61101-A-91A)
(AD-A005572; FA-TM-74035) Avail: NTIS CSCL 19/1

The purpose of this work was to determine the feasibility of a new idea for applying rotating bands to projectiles. The idea is the in-situ fusion of the rotating band material in a graphite crucible fitted around the projectile. Various heating and shielding methods were explored. It was found that several materials could be successfully deposited using induction or furnace heating in an Argon atmosphere. Metallographic studies and post-application, heat treating studies were carried out. Several bands fused on 30 mm projectiles were successfully fired through a 30 mm cannon. GRA

N75-28212# Rockwell International Corp., Los Angeles, Calif.
NONDESTRUCTIVE DETECTION OF STRUCTURAL DAMAGE UNIQUELY ASSOCIATED WITH FATIGUE Aircraft Report, 1 Jun. 1972 - 31 May 1974
J. F. Moore, S. Tsang, D. O. Thompson, and S. A. Hoenig (Arizona Univ., Tucson) Jul. 1974 224 p refs
(Contract F33615-72-C-1733; AF Proj. 7351)
(AD-A005357; NA-74-342; AFML-TR-74-131) Avail: NTIS CSCL 11/6

The program was directed at the development of reliable nondestructive testing and inspection methods to locate and assess fatigue damage in Air Force aircraft structures. The primary nondestructive test approach is the application of exoelectron emission to the detection of fatigue damage. Initially, a series of controlled fatigue tests were conducted in an ultrahigh vacuum chamber to fully characterize the surface state of the specimen prior to, during, and after fatigue measurement. Next, a series of fatigue tests were conducted in air on specimens of different shapes with and without discontinuities under various loading and environmental conditions, in order to develop a practical technique for applying exoelectron emission and surface potential difference measurements to assess fatigue damage as well as to predict final failure sites. A prototype system design for the automatic scanning and exoelectron emission testing of aircraft-type structures was developed. GRA

N75-28213# Dreher (John J.), Arcadia, Calif.
STATIC AND DYNAMIC INTERPRETATION OF TITANIUM ALLOY PHOTOMICROGRAPH FEATURES Technical Report, 15 Feb. 1973 - 15 Feb. 1974
John J. Dreher Nov. 1974 75 p refs
(Contract F33615-73-C-5108; AF Proj. 7353)
(AD-A005358) Avail: NTIS CSCL 11/6

Computer and hand generated geometrical data from Ti-6Al-2Sn-4Zr-6Mo photomicrographs were statistically treated to establish family groupings of certain physical properties. These families, established by duration and freepath distribution functions, define various statistically different packets of mechanical properties which correlate to various degrees with other measured geometries. Following an Air Force Materials Laboratory (AFML) specification of an acceptable mechanical property profile, ten qualifying samples were additionally subjected to analyses sensitive to particle mass and spatial placement. Two novel methods, autocorrelation of particle mass equivalents and a stroboscopic pattern detection technique, indicated the interrelations of spatial distribution patterns and the properties of ductility, fatigue resistance, toughness, and crack propagation. GRA

N75-28214# Army Foreign Science and Technology Center, Charlottesville, Va.
STANDARDIZATION OF QUALITY STEEL
A. S. Kaplan 18 Sep. 1974 16 p Transl. into ENGLISH from the book "Metallurgiya" Moscow, 1972 p 349-359
(AD-A005486; FSTC-HT-23-0028-75) Avail: NTIS CSCL 11/6

The basic conditions for standardization of quality and special steels and alloys are presented. Classified groupings of brands of steel used when developing standards and their effect on the system of designating brands for standardization are covered. Basic technical terms and concepts in the field of standardization are covered. Brief characteristics of basic effective state standards, reasons for their development and basic distinctive peculiarities, methodical instructions on questions of developing standards and technical specifications are given. Separate questions of international standardization are covered. GRA

N75-28215# British Steel Corp., Sheffield (England). Information Services.
THE EFFECT OF SLAB TO PLATE DEFORMATION RATION ON PROPERTY DIRECTIONALITY OF ESR AND CONTINUOUSLY CAST STEELS
J. H. Little, A. A. F. McCombe, and R. C. Ratnapuli Feb. 1975 40 p refs
(PB-240595/9; GS/PROD/506/5/74/C;
GS/PROD/173/2/74/C) Avail: NTIS HC $3.75 CSCL 11F

By using the electroslag remelting (ESR) process to effect controlled ingot solidification, plates were produced in both pilot and commercial plants, exhibiting exceptionally high absolute values of ductile Charpy V-notch shelf energy and through-the-thickness tensile ductility. The influence of rolling deformation from cast slab to plate was examined using as criteria the anisotropy of Charpy V-notch and tensile properties. This work has included an examination of trial plates rolled from various continuous slab casting plants. The basis for the change of properties is examined to assess the contribution of inclusion type, size and distribution, and change in microstructure with increasing slab to plate deformation. GRA

N75-28216# Naval Research Lab., Washington, D.C.
CYCLIC-CRACK-GROWTH AND FRACTURE RESISTANCE OF Ti-6Al-6V-2Sn AS INFLUENCED BY RECRYSTALLIZATION ANNEAL AND INTERSTITIAL OXYGEN CONTENT, PHASE 1 Final Report
K. R. Kondas, T. W. Crooker, and C. M. Gilmore 8 Oct. 1975 17 p refs
(NRL Proj. M01-24; RR0220146)
(AD-A004970; NRL-7844) Avail: NTIS CSCL 11/6

The study was undertaken to determine methods for metallurgical improvement of cyclic-crack-growth and fracture properties in Ti-6Al-6V-2Sn. Two heats of the alloy were studied: an alpha + beta-processed material containing 0.16% interstitial oxygen and a beta-processed material containing 0.08% interstitial oxygen. All test specimens were given a mill anneal heat treatment; in addition some specimens from each heat were given a recrystallization anneal heat treatment. Fatigue-crack growth rates were determined using compact tension specimens, and fracture toughness was determined using 1-in. dynamic tear specimens for each combination of material and heat treatments. The combined effects of recrystallization anneal plus a reduction in interstitial oxygen content significantly improved the cycle-crack-growth properties of Ti-6Al-6V-2Sn. GRA

N75-28217# Delaware Univ., Newark. College of Engineering.
THE EFFECT OF A THIN DIFFUSED SOLUTE LAYER ON THE NUCLEATION OF FATIGUE CRACKS Final Report
I. G. Greenfield, Mary Swain, and Derle M. Snyder Jan. 1975 23 p ref
(Grant AF-AFOSR-2094-71; AF Proj. 6813; AF Proj. 9782)
(AD-A005722; AFOSR-75-0212TR) Avail: NTIS CSCL 11/6

The purpose of this study was to investigate methods of controlling the nucleation and growth of fatigue cracks in Ti-6Al-4V Alloy. The technique employed was based on the development of a thin diffused concentration profile of a second element in the surface layers of the specimen. If the deformation characteristics of the thin layer lead to the delay of the development of the start of fatigue cracks, then the lifetime of the alloy can be increased. Moreover, since environmental conditions affect fatigue, the chemical nature of the surface layers might impede crack growth once it is started. The results of the experiments conducted show that specific concentration profiles of solutes improve the fatigue life of the alloy. Most interesting was the fact that dissolved oxygen in a thin layer at the surface is beneficial to the fatigue life of titanium alloy. GRA

N75-28218# Austin Science Associates, Inc., Tex.
SURFACE STRESS MEASUREMENT WITH THE MOSSBAUER EFFECT Final Report, Dec. 1970 - Nov. 1974
C. M. Yagnik, R. L. Collins, and R. A. Mazak 1 Nov. 1974 47 p refs

(Contract DAAK02-71-C-0110)
(AD-A005581) Avail: NTIS CSCL 11/6

An instrument has been conceived, designed, constructed, and tested for the non-destructive measurement of residual surface stresses in ferrous metals, based on the Mossbauer effect. Stress influences the Mossbauer effect on a fundamental level--the atomic wave functions are compressed or expanded and so shift the energy at which resonance occurs. Instrumentation capable of this measurement has been difficult of attainment. Because of the nature of the samples to be analyzed, it was essential that backscatter detectors be developed. A thermal-scanning technique was developed to vary the gamma-ray energy with the precision needed. It was also necessary to measure the percentage Mossbauer effect on the sample under study, and the concept evolved of spoiling the resonance during temperature changes of the source. The low signal/noise required that data be accumulated over several hours, and computer-aided data reduction was essential. Precision achieved is currently a few KSI. GRA

N75-28219# Aluminum Co. of America, Alcoa Center, Pa.
PROGRAM TO DEVELOP HIGH STRENGTH ALUMINUM POWDER METALLURGY PRODUCTS. PHASE 4: SCALE-UP TO 3200 POUND BILLETS Quarterly Report, 20 Dec. 1973 - 19 Mar. 1974
Walter S. Cebulak 5 Dec. 1974 19 p refs
(Contract DAAA25-72-C-0593)
(AD-A005661; QR-7) Avail: NTIS CSCL 11/6

Cracking of the 3100 lb isostatic compact due to water leaking into the rubber mold and the low compact strength led to a process revision. Vibratory powder packing in the vacuum preheat container will replace cold isostatic pressing prior to encapsulation for vacuum preheating. Eight lots of powder were produced for powder billet fabrication, four lots each in MA87 and MA67 alloys. Vacuum can design was developed to maximize the powder weight in the hot compacting tools. By vibratory packing, powder density was raised from 45% to 59% of theoretical density. An evacuation line pinch-off tool was designed, constructed and successfully used to close 2-in. aluminum pipe. GRA

N75-28220# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
DYNAMIC COMPRESSIVE STRAIN RATE TESTS ON SEVERAL GRADES OF BERYLLIUM Final Report, Nov. 1973 - Jun. 1974
T. Nicholas and M. J. Sever Nov. 1974 35 p refs
(AF Proj. 7351)
(AD-A005701; AFML-TR-74-224) Avail: NTIS CSCL 11/6

Results of static and dynamic compression tests on several grades of beryllium and lockalloy are presented. A split Hopkinson pressure bar system, used to generate data at strain rates up to 1000/sec, is described in detail. Stress-strain curves show several different grades of beryllium to have a moderate amount of strain rate sensitivity in compression in the plastic region. GRA

N75-28221# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
FRACTURE MECHANICS TESTS AND ANALYSES OF THE AEDC APTU STORAGE VESSEL MATERIAL Final Report, Jun. 1973 - Jun. 1974
Allan W. Gunderson Oct. 1974 42 p refs
(AF Proj. 7381)
(AD-A005698; AFML-TR-74-133) Avail: NTIS CSCL 11/6

A test program to evaluate cyclic crack growth rates and residual strengths of flawed panels has been completed. The test specimens were from representative high pressure air storage tanks similar to those used in the AEDC APTU test facility. The test results reported herein, coupled with the proof test performed at AEDC, provide the data base to use a proof test logic methodology for estimating the minimum cyclic life of the storage tank field. GRA

N75-28222# Purdue Univ., Lafayette, Ind. Dept. of Materials Engineering.
DEVELOPMENT OF A MODULATED MICROSTRUCTURE HEAT TREATABLE STEEL Semiannual Technical Report, 1 Jul. - 31 Dec. 1974
P. G. Winchell and Daniel Ng 28 Jan. 1975 29 p refs
(Grant DAHC15-73-G-12; ARPA Order 2340)
(AD-A004884; SATR-2) Avail: NTIS CSCL 11/6

The objective of this research is to design and develop an alloy complex of modulated-mocrostructure steel (MMS) with a tensile strength of 400 ksi(2.8 KN/(mm squared) and fracture toughness of 150 ksi (the square root of in)(160 N/(mm squared)(the square root of m). The alloy complex combines layers of high strength steel with layers of partially austenitic steel. The full strength of the hard layer is usable because the ductility of the softer layer provides toughness which inhibits crack propagation. A model system whose hard layer is an 01 commercial tool steel and whose soft layer is a specially designed alloy (PS2) was manufactured and tested. A most important step in the fabrication process was to insure that the complex layers will partially debond when they are subject to stresses thus improving the fracture toughness. In the 01/PS2 system partial debonding is accomplished by the presence of oxide particles which are introduced into the interface for that purpose. This report summarizes development of that system and also further work on controlled interfacial bonding. GRA

N75-28223# Pittsburgh Univ., Pa. Dept. of Metallurgical and Materials Engineering.
INTERNAL OXIDATION OF DILUTE Co-Ti ALLOYS
Janez Megusar and Gerald H. Meier 20 Nov. 1974 48 p refs
(Contract N00014-67-A-0402-008; NR Proj. 031-749)
(AD-A005638; MME-IO-74-2) Avail: NTIS CSCL 11/6

The kinetics of internal oxidation of Co-Ti alloys and the crystal structures and morphologies of the internal oxide particles have been investigated in the temperature range 900 to 1080C. Three oxides were observed: sigma-TiO, TiO2 (rutile) and CoTiO3. The permeabilities of oxygen in Co were calculated from the observed internal oxidation kinetics using an analysis due to Meijering and an analysis based on a more rigorous solution of the diffusion equations. The factors affecting the size and morphology of internal oxide particles are discussed. GRA

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

N75-28224 British Library Lending Div., Boston Spa (England).
ABSORPTION IN MATERIALS FOR OPTICAL FIBRES
Alcibiade Zaganiaris and Gerard Bouvy 9 Dec. 1974 15 p refs Transl. into ENGLISH from Ann. Telecommun. (France), v. 29, nos. 5-6, 1974 p 189-194
(BLL-TRANS-3187-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A calorimetric method is described for measuring the absorption coefficient in glasses for optical fibers. This coefficient was found by two independent methods from the same thermogram and the results are close. The sensitivity is less than one decibel per kilometer and can be increased; it is sufficient for all optical fibers at present available. Author

N75-28225 Michigan Technological Univ., Houghton.
A STUDY OF THE ROLE OF IMPURITIES AND ADDITIVES ON CERAMIC DENSIFICATION
William C. Johnson 1973 114 p
Avail: Univ. Microfilms Order No. 75-14393

Auger electron spectroscopy has been used to study the role of interfacial impurities on ceramic densification. Sintered Al2O3 doped with MgO was studied in order to verify directly the evidence for grain boundary segregation. Although a slight increase in Mg over the bulk value was observed at the grain boundaries, the only species present in a significant amount was Ca. NiO doped alumina similarly showed no massive segregation of the additive, but did exhibit heavy Ca segregation. Aluminas doped with Y2O3 did show segregation of the additive along with Ca segregation, while pure Al2O3 and CaO doped

Al2O3 exhibited only Ca segregation. The results indicate that solute segregation does not play a major role in densification of Al2O3 and an alternate theory was presented based on enhanced diffusion in a doped ionic material. Dissert. Abstr.

N75-28226 Compagnie Generale d'Electricite, Marcoussis (France). Dept. Recherches Physiques de Base.
PREPARATION OF TRANSPARENT ELECTROOPTICAL CERAMICS Final Report [ELABORATION DE CERAMIQUES TRANSPARENTES ELECTRO-OPTIQUES]
Yvon Lazennec May 1974 31 p refs In FRENCH
(Contract DGRST-73-7-1452)
Avail: Issuing Activity

A monoclinic form of Ba(x)Sr(1-x)Nb2O6 was found by synthesizing powders used for preparing transparent ceramics. Its crystallographic parameters and space group for X=0,29, and the stability as a function of X and temperature were determined. The influence of this phase on fritting conditions used for obtaining ceramics of density near theoretical was studied. Specimens of high transparency were obtained. ESRO

N75-28227*# Scientific Translation Service, Santa Barbara, Calif.
DECOMPOSITION TEMPERATURE OF SILICON NITRIDE IN THE SYSTEM Si3N4-C-N2 (1 ATM)
Yoshizo Nomata and Zenzaburo Inoue Washington NASA Jul. 1975 15 p refs Transl. into ENGLISH from Yogyo Kyokai Shi (Japan), v. 81, no. 10, 1973 p 441-444
(Contract NASw-2483)
(NASA-TT-F-16450) Avail: NTIS HC $3.25 CSCL 11G

Direct measurements of decomposition temperature of silicon nitride are performed in the highly pure system of Si3N4-C-N2 (1 atm). The result obtained here, 1839 deg + or - 14 C, is the lowest value among the temperature reported. Errors between those temperatures are discussed. Some single crystals of beta-Si3N4 are obtained through those experiments and the growth conditions are briefly reported. Author

N75-28228*# Hughes Aircraft Co., Culver City, Calif. Aerospace Groups.
DEVELOPMENT OF AN OPTIMIZED INTUMESCENT COATING Summary Report
Norman Bilow and Seymour S. Schwartz Jul. 1975 92 p refs
(Contract NAS2-8139)
(NASA-CR-137706; HAC-P75-223) Avail: NTIS HC $4.75 CSCL 11C

Intumescent coatings for small diameter air launched missiles were studied. An aerodynamically smooth, moderately flexible coating, with excellent thermal efficiency was developed. Author

N75-28229*# Martin Marietta Corp., Denver, Colo.
NONMETALLIC MATERIALS HANDBOOK
Dec. 1974 304 p
(Contract NAS1-13177)
(NASA-CR-132673) Avail: NTIS HC $9.25 CSCL 11G

A handbook compilation of chemical and physical property tests data obtained during qualification and receiving inspection testing of nonmetallic materials for the Viking Lander is introduced. Data cover the following materials: sealants, potting compounds, lubricants, paints and finishes, inks, films, encapsulants, elastomers, structural plastics, ablatives, adhesives, and electrical and thermal insulation. Thermochemical data showing degradation as a function of temperature, from room to 500 C, are included. Author

N75-28230*# Ultrasystems, Inc., Irvine, Calif.
FLAME RESISTANT NONTOXIC POLYMER DEVELOPMENT Final Report, 7 Jan. 1974 - 7 May 1975
K. L. Paciorek, D. W. Karle, and R. H. Kratzer May 1975 81 p refs
(Contract NAS9-13802)
(NASA-CR-141932; SN-3900-F) Avail: NTIS HC $4.75 CSCL 07C

A number of homopolymers, copolymers, and terpolymers were synthesized employing styrene and four derivatives of diphenyl-p-styrylphosphine. The various polymeric compositions were prepared by two processes, (1) monomer bulk polymerizations and (2) substitution of preformed polydiphenyl-p-styrylphosphine. Results indicate that the majority of the compositions exhibit superior melting and flame retardant characteristics as compared to polystyrene, but are inferior in molding and film forming capability. Terpolymerization appears to result in the materials with the best overall combination of properties. Toxicological evaluation of three representative basic compositions in the form of molded washers showed that no mortalities occurred among the test animals exposed to the products of the oxidative thermal decomposition of the three materials. Author

N75-28231*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
OUTGASSING DATA FOR SPACECRAFT MATERIALS
William A. Campbell, Jr., Richard S. Marriott, and John J. Park Washington Jul. 1975 164 p refs
(NASA-TN-D-8008; G-7570) Avail: NTIS HC $6.25 CSCL 11G

Outgassing data, derived from tests at 398 K (125 C) for 24 hours in vacuum, were compiled for numerous materials for spacecraft use. The data presented are the total mass loss and the collected volatile condensable materials. The various materials are compiled by likely usage and alphabetically. Author

N75-28232# Pennsylvania State Univ., University Park. Materials Research Lab.
COMBINED ELLIPSOMETRIC AND SOFT X-RAY SPECTROSCOPIC STUDIES OF CORROSION PROCESSES ON TRANSPARENT MATERIALS Final Report, 1 Apr. 1972 - 31 Dec. 1974
K. Vedam and E. W. White 31 Dec. 1974 66 p refs
(Contract N00014-67-A-0385-001816; NR Proj. 032-523)
(AD-A005656) Avail: NTIS CSCL 11/2

It is shown that ellipsometry can be used to non-destructively characterize the contaminant surface film as well as the damaged surface layers on optically transparent materials. The results of ellipsometric measurements on vitreous silica glasses and potassium chloride single crystal specimens subjected to various surface treatments such as mechanical polishing, chemical etching and sputter-cleaning are presented and discussed. A new generalized method has been developed for the evaluation of all the optical parameters of the system: Optically absorbing film on an optically opaque substrate. The method involves the ellipsometric measurements on such a system and the analysis of such data using exact equation of ellipsometry. Finally, the report describes the development of a model and its preliminary evaluation for non-destructive depth profiling of elemental concentrations with the help of soft X-ray spectroscopy. GRA

N75-28233# Alabama Univ., University. Dept. of Chemistry.
THE USE OF COMPUTERS TO STUDY THE PENULTIMATE AND THE CHARGE-TRANSFER POLYMERIZATION MODELS
Charles U. Pittman, Jr. and Thane D. Rounsefell 15 Jan. 1975 48 p refs
(Contract N00014-73-A-0361)
(AD-A004949; TR-8) Avail: NTIS CSCL 07/3

Three programs have been written for evaluating the charge-transfer copolymerization model when operating in competition with the terminal model. The first program (Program CT-1) permits the calculation of r(1), r(1c2), r(1c2), r(2), r(2c2), r(2c1), and K from composition-conversion data. The second program (Program CT-2) allows one to design the optimum concentrations of M(1) and M(2) to use in experimental work. The third program (Program CT-3) calculates the copolymer composition, at any conversion, using charge-transfer model equation in the most general case. The need for a nonlinear solution is discussed and a nonlinear approach is used which simultaneously permits an objective analysis of the reliability of the method. The sensitivity of predictions to errors in polymer composition and percent conversion were investigated. Finally, it was demonstrated that no adequate composition-conversion data exists in the literature which can be used to test for a combined-charge-transfer and terminal model copolymerization. The method developed in this paper provide the guide necessary for obtaining such data. GRA

N75-28234# Alabama Univ., University. Dept. of Chemistry.
SEQUENTIAL MULTISTEP REACTIONS CATALYZED BY POLYMER-ANCHORED HOMOGENEOUS CATALYSTS
Charles U. Pittman, Jr. and Larry R. Smith 15 Jan. 1975 30 p refs
(Contract N00014-73-A-0361)
(AD-A004947; TR-6) Avail: NTIS CSCL 07/3

The first examples of sequential miltistep organic reactions carried out over polymer-anchored homogeneous catalysts are reported where two such catalysts are bound to the same crosslinked polymer. Also, sequential catalytic reactions where two catalysts, each anchored to a separate resin, are mixed together in the same reactor were conducted. Sequential cyclooligomerization of butadiene to 4-vinylcyclohexene, (Z,Z)-1,5-cyclooctadiene, and (E,E,E)-1,5,9-cyclododecatriene, followed by hydrogenation to ethylcyclohexane, cyclooctane, and cyclododecane, was accomplished using a single styrene-divinylbenzene resin to which (PPh3)2Ni(CO)2 and (PPh3)3RhCl had been anchored. The same reaction sequence was effected by a mixture of two resins to which (PPh3)2Ni(CO)2 and (PPh3)RhCl were individually attached. GRA

N75-28235# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMAL EMISSION PROPERTIES OF RARE EARTH METALS
O. K. Kultashev and S. E. Rozhkov 9 Jul. 1974 8 p refs Transl. into ENGLISH from the mono. "Redkozemel. Metally i Splavy" Moscow, Nauka Press, 1971 p 57-59
(AD-A005206; FSTC-HT-23-761-74) Avail: NTIS CSCL 07/4

The work functions of a number of rare earth metals have been calculated from data of experimental sputtering of rare earth metals of high purity onto a tungsten or rhenium substrate through an anode slit in a vacuum tube. The work functions appear to change uniformly, with the exception of divalent europium and, in the yttrium subgroup, lutetium. It is proposed that the total change in phi from lanthanum to lutetium is determined to a certain extent by the lanthanide compression. An additional factor is thought to be the reactions of free electrons with the f-shells, especially the resonance reactions. GRA

N75-28236# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EVALUATION OF EXPERIMENTAL POLYURETHANE-COATED MEMBRANES Final Report
Timothy W. Vollor Jan. 1975 68 p refs
(DA Proj. 1T0-62103-A-046)
(AD-A005151; AEWES-TR-S-75-1) Avail: NTIS CSCL 13/3

This report describes an investigation conducted for the development of an improved flexible prefabricated membrane surfacing suitable as an expedient dustproofing and waterproofing medium for soil subgrades used as forward-area airfields and road surfacings. This was accomplished by means of: laboratory tests of PUC membranes, adhesives, and nonskid compounds to determine physical properties, and skid tests simulating C-130 braking action on nonskidcoated PUC membranes placed on a soil subgrade to determine skid resistance and durability. GRA

N75-28237# Naval Civil Engineering Lab., Port Hueneme, Calif.
ADHESIVES FOR USE UNDERWATER Final Report, Jul. 1972 - Jun. 1974
Richard W. Drisko, J. B. Crilly, and R. M. Staples Dec. 1974 18 p refs
(ZF61512001)
(AD-A004938; CEL-TR-1367) Avail: NTIS CSCL 11/1

An investigation was conducted into finding materials and procedures for mixing, applying, and curing rapid-setting epoxy adhesives under seawater. Separate formulations were developed for use at 5C and 20C They were easily mixed and applied underwater from a plastic cartridge. A simple system of chemical heating was found to accelerate underwater curing, especially in cold waters. GRA

N75-28238# Naval Civil Engineering Lab., Port Hueneme, Calif.
FIELD TESTING OF WATER EMULSION EPOXIES Technical Note, Jul. 1973 - Jun. 1974
R. W. Drisko and J. B. Crilly Feb. 1975 16 p refs
(YF54543006)
(AD-A004935; CEL-TN-1374) Avail: NTIS CSCL 11/3

The Civil Engineering Laboratory conducted a field test of two water emulsion epoxy coatings, a low solvent epoxy coating, a regular solvent epoxy coating, and a control alkyd coating. The coatings were placed on either sandblasted steel panels or over weathered alkyd coating panels for exposure at Kwajalein, Marshall Islands (a marine atmospheric environment). Test data were collected after one-half year and 1 year of exposure; the test panels are still in position for further study. After 1 year of exposure, the low solvent epoxy and the alkyd control panels are in better condition than the two water emulsion epoxy systems and the regular solvent epoxy panels. GRA

N75-28239# Naval Civil Engineering Lab., Port Hueneme, Calif.
PERMEATION OF CHLORIDE AND SODIUM IONS THROUGH PROTECTIVE COATING FOR NAVAL SHORE STRUCTURES Technical Note, Nov. 1969 - Jun. 1973
E. S. Matsui Feb. 1975 27 p refs
(ZF61512001)
(AD-A004934; CEL-TN-1373) Avail: NTIS CSCL 11/3

A method of measuring the permeability of salt ions through a paint film by the radiometric method is elaborated. It demonstrates that the radiometric method is precise and sensitive. The radiometric method is also useful in the investigation of other parameters which influence permeability of salt ions through paint films. GRA

N75-28240# Ceramic Finishing Co., State College, Pa.
THE VARIATION OF FRACTURE MIRROR RADIUS WITH FRACTURE STRESS FOR POLYCRYSTALLINE CERAMICS UNDER VARIOUS LOADING CONDITIONS
Henry P. Kirchner, Robert M. Gruver, and William A. Sotter Nov. 1974 93 p refs
(Contract N00014-74-C-0241; NR Proj. 032-545)
(AD-A004998; TR-2) Avail: NTIS CSCL 11/2

In this report, the results of fracture mirror measurements on a wide variety of ceramic materials fractured in flexural tests at various temperatures and in delayed fracture and impact tests at room temperature are presented. Much of this work was done by fractographic observations on alumina, silicon nitride, zircon, steatite, and silicon carbide specimens fractured in an earlier investigation of flaws at fracture origins. GRA

N75-28241# Army Foreign Science and Technology Center, Charlottesville, Va.
DEVELOPMENT OF ELECTROSTATIC SPINNING
B. P. Radovitskii, B. N. Streltsov, and A. G. Liapin 2 Mar. 1974 13 p refs Transl. into ENGLISH from Tekst. Prom. (USSR), no. 9, 1969 p 36-41
(AD-A004926; FSTC-HT-23-1632-73) Avail: NTIS CSCL 11/5

Any process of electrospinning involves the separation of fibers and a decrease in their line density during the subsequent condensation of flow. It is expedient to use an electric field in the process of transport, orientation and condensation; the methods having the greatest potential are those which use electric transportation of fibers, or the method based on the formation of thread in an electromechanical field of frictional forces created by a corona discharge. GRA

N75-28242# Ceramic Finishing Co., State College, Pa.
FRACTOGRAPHY OF CERAMICS Summary Report, 22 Feb. 1973 - 22 Nov. 1974
Robert M. Gruver, William A. Sotter, and Henry P. Kirchner 22 Nov. 1974 236 p refs
(Contract N00019-73-C-0356)
(AD-A003911) Avail: NTIS CSCL 11/2

Alumina and hot pressed alumina, silicon nitride and silicon carbide were fractured at various loading rates and temperatures. The fracture surfaces were studied by optical and scanning electron microscopy. The fracture origins were located and the flaws at the fracture origins were identified, characterized and classified according to various types. Fracture stress vs. flaws size curves were plotted for various types of flaws. Applications of these results to ceramic processing, designing with brittle materials and theories of fracture are also discussed. GRA

N75-28243# Whittaker Corp., San Diego, Calif. Research and Development Div.
INVESTIGATION OF REINFORCED PLASTICS FOR NAVAL AIRCRAFT ELECTROMAGNETIC (EM) WINDOWS Final Report, Aug. 1973 - Oct. 1974
Vance A. Chase Jan. 1975 92 p refs
(Contract N00019-74-C-0055)
(AD-A005170; MJO-3043) Avail: NTIS CSCL 11/9

Polymer and fiber materials for naval radome applications were investigated. The investigation was concerned with materials having low and stable dielectric constant and loss tangent properties. Primary emphasis was on polybutadiene polymers, with various other classes of polymers including thermoplastics being investigated as secondary candidates. A survey was conducted on the availability of polybutadiene polymers and a characterization study performed on 14 different resins from three manufacturers. Secondary resin candidates, which included polysulfones, polyimides, polyphenylquinoxalines, and polyamide-imides, were evaluated. Composite processing studies were conducted for the more promising resin candidate materials. Investigations were conducted into fiber finishes and surface treatments compatible with the polybutadiene resin for both fiber reinforcements. GRA

N75-28244# Picatinny Arsenal, Dover, N.J.
COOPERATIVE PROGRAM FOR DESIGN, FABRICATION, AND TESTING OF GRAPHITE-EPOXY COMPOSITE HELICOPTER SHAFTING Progress Report
Charles C. Wright, Donald J. Baker, L. Thurston, and R. Clary Dec. 1974 96 p refs
(DA Proj. 1T1-62105-A-331)
(AD-A005024; PA-TR-4688; PR-2) Avail: NTIS CSCL 11/4

A design methodology employing computer programs was developed and used to provide five designs of composite helicopter tail rotor drive shaft segments. Shaft test specimens were fabricated from MODMOR I and CELION GY-70 graphite fiber reinforced epoxy resin. Results from the laboratory testing of these 18-inch (nominal) long specimens plus those from a previously fabricated THORNEL 50S specimen were used to compute performance expected from standard 57-inch (nominal shaft segments). All designs tested exceeded the minimum design requirements for stiffness, fatigue life, Vibration, and residual strength. When the artificial constraints of windup and segment length were removed, the developed design methodology using a composite of 75 million psi modulus fiber and ERLB 4617 epoxy resin yielded a shaft train of only three segments. These tubes were only 39% as heavy as their aluminum counterparts; the combined weight savings from lighter tubes and bearing assembly elimination due to longer shaft segments resulted in a 53.1% weight saving for the total shaft train if compared with the current 2024 aluminum shaft train. GRA

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers, storage and handling; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N75-28245 California Univ., Davis.
ANALYSIS AND DESIGN OF A PYROTECHNIC-POWERED SELF-STOPPING ACTUATOR Ph.D. Thesis
Vadim Kopytoff 1974 143 p
Avail: Univ. Microfilms Order No. 75-15414

Safety and environment considerations necessitate the use of automatic emergency shut-off valves in nuclear power-plants, underground nuclear tests, oil pipelines and even oil wells. Such valves require actuators to move a member (e.g., a gate, a stem or a ball which may weigh hundreds of pounds) in a time that may be as short as a fraction of a second, and which must have some provision for decelerating the moving body at the end of its stroke to avoid a damaging impact. A device for satisfying these requirements with the high reliability required for such systems is proposed. This device consists of a double-acting piston driven by gas generated by the combustion of a propellant, with the novel feature of using a precisely determined straight hole through the piston to provide a gas cushion for deceleration during the last part of the stroke.
Dissert. Abstr.

N75-28246*# Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Mechanical Engineering.
ANALYSIS OF SOLID-ROCKET EFFLUENTS FOR ALUMINUM, SILICON, AND OTHER TRACE ELEMENTS BY NEUTRON ACTIVATION ANALYSIS Semiannual Progress Report, Jul. - Dec. 1974
A. Keith Furr Dec. 1974 3 p
(Grant NsG-1119)
(NASA-CR-143208) Avail: NTIS HC $3.25 CSCL 20I

The sensitivity and reliability of neutron activation analysis in detecting trace elements in solid rocket effluents are discussed. Special attention was given to Al and Si contiminants. The construction and performance of a thermal column irradiation unit was reported. E.H.W.

N75-28247*# National Aeronautics and Space Administration, Washington, D.C.
LIQUID ROCKET ENGINE COMBUSTION STABILIZATION DEVICES NASA Space Vehicle Design Criteria (Chemical Propulsion)
Nov. 1974 127 p refs
(NASA-SP-8113) Avail: NTIS HC $5.25 CSCL 21I

Combustion instability, which results from a coupling of the combustion process and the fluid dynamics of the engine system, was investigated. The design of devices which reduce coupling (combustion chamber baffles) and devices which increase damping (acoustic absorbers) are described. Included in the discussion are design criteria and recommended practices, structural and mechanical design, thermal control, baffle geometry, baffle/engine interactions, acoustic damping analysis, and absorber configurations. M.J.S.

N75-28248# Stanford Research Inst., Menlo Park, Calif.
SYNTHETIC PETROLEUM FOR DEPARTMENT OF DEFENSE USE Final Report, 8 May - 14 Nov. 1974
Richard L. Goen, Carroll F. Clark, and Michael A. Moore Nov. 1974 120 p refs
(Contract F30602-74-C-0265; ARPA Order 2740)
(AD-A005403; SRI-EGU-3401; AFAPL-TR-74-115) Avail: NTIS CSCL 21/4

The study assesses the feasibility of meeting part of the DoD energy requirements by synthetic petroleum (syncrude) from coal. The DoD petroleum requirements are summarized. The various syncrude processes are described, and the technical and economic aspects of converting a typical eastern coal and a typical western coal to refinery grade syncrude are analyzed. Refining of this syncrude is analyzed for several cases involving either new plants or modifications to existing refineries, and alternative product slates. Plant location considerations, schedules, and constraints are also covered. GRA

N75-28249# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
STAGE 1 PROPELLANT, SURVEILLANCE REPORT, GLACIAL ACRYLIC ACID, MOTORS GAA-001 AND GAA-002, TP-H1011 Semiannual Test Results Report
John A. Thompson Oct. 1975 110 p
(AD-A005416; MANCP-313(74)) Avail: NTIS CSCL 21/9

Glacial acrylic acid monomer was used in place of aqueous acrylic acid to synthesize the polymer binder in some Stage I Minuteman propellant. Cartons of this propellant representing the propellant in motors GAA-001 and GAA-002 were tested. This report compares the results of this testing with previous testing of LGM-30F and G propellant that contained aqueous acrylic acid. The results of this testing were compared by inserting the new data into previously prepared LGM-30F and G regression analyses. Visual comparison of the parameters tested indicates that the glacial acrylic acid propellant is similar to the F and G propellant. Most of the results are within the F and G 90/90 tolerance band. Each point on the previously prepared regression plot represents all F and G samples at that particular age. The glacial acrylic acid results are plotted by motor and each motor

is represented by a separate point (GAA-001 is represented by a circle and GAA-002 by a square). Author

N75-28250# Naval Ordnance Lab., White Oak, Md.
PREDICTION TECHNIQUES FOR REFRACTION OF UNDERWATER EXPLOSION SHOCK WAVES: A SHIPBOARD COMPUTER PROGRAM
J. A. Goertner 4 Dec. 1974 74 p refs
(AD-A004942; NOLTR-74-157) Avail: NTIS CSCL 19/4

Because of the spatial and temporal variation of refractive conditions in the ocean, a capability is required for making on-board predictions of refractive effects on safe delivery ranges for submarine-launched nuclear weapons. The computer program (CARE) described in this report indicates the feasibility of such a shipboard prediction capability. The program can be converted for use on any multipurpose computer having a storage capacity of about 16K, which is well within the specifications for currently used Navy computers. GRA

N75-28251# Singer Co., Little Falls, N.J. Kearfott Div.
TARGET SEEKING/HEIGHT SENSING FUSING CONCEPT Final Report, Mar. 1974 - Feb. 1975
Feb. 1975 99 p
(Contract DAAA21-74-C-0654)
(AD-A005674; Y258A327) Avail: NTIS CSCL 19/1

The report describes the investigative and analytic effort directed toward determining feasibility of the Height Sensing Target Sensing Fusing Concept, (HS/TS FCS). The period covered is March 1974 to February 1975, inclusive. Required control system and guidance laws for a baseline vehicle are established. Associated vehicle maneuver characteristics are defined and six-degree-of-freedom simulations run to verify concept feasibility. Tentative gimbal-less sensor configurations are analyzed to define target acquisition and terminal homing requirements. Active and passive modes of operation are compared. Antenna performance and size tradeoffs are investigated for compatibility with vehicle geometry maneuver capability, and acquisition and track performance. GRA

N75-28252# Ogden Air Logistics Center, Hill AFB, Utah. Propellant Lab. Section.
PROPELLANT SURVEILLANCE REPORT LGM-30A/B SPACE 1 TP-H1011 Semiannual Report
John A. Thompson Nov. 1974 102 p refs
(AD-A005705; MANCP-302(74)) Avail: NTIS CSCL 16/4

This report contains propellant test results from cartons of TP-H1011 bulk propellant representing LGM-30A and B First Stage Minuteman Motors. This report is the sixth time that a statistical approach has been used to analyze First Stage bulk carton propellant. Testing was accomplished in accordance with MMEMP Project M52258M-123P(74NE458). The purpose of testing was to determine and provide early warning of any serious degradation trends occurring in the propellant for service life predictions. An analysis of all parameters indicates that no potential problems are expected for at least two years past the oldest data point. Data stored in the G085 System were plotted using the IBM 360-65 Computer and CAL-COMP Plotter. The data range at any age can be found by suitable inquiry of the G085 System. GRA

N75-28253# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
AN INVESTIGATION OF DIESEL FUEL COMPOSITION-EXHAUST EMISSION RELATIONSHIPS Interim Report
John C. Tyler, J. T. Gray, and W. D. Weatherford, Jr. Oct. 1974 24 p refs
(Contract DAAD05-72-C-0053)
(AD-A005077; AFLRL-42) Avail: NTIS CSCL 21/4

The present investigation has been conducted to study the effects of hydrocarbon composition and additive content of diesel fuels on exhaust pollutant emissions. The reported results were obtained using a two-cylinder, four-stroke cycle Onan diesel engine-generator unit instrumented for exhaust emissions measurements. Seven different fuels and fuel blends having aromatic contents varying from 0 to 74 percent and cetane numbers from 37 to 71 were investigated. The results of this study demonstrate that increasing concentrations of aromatic hydrocarbons in the fuel significantly increase emission of oxides of nitrogen while slightly decreasing the emission of unburned hydrocarbons, while other fuel characteristics, including cetane number, remain essentially constant. A full-scale, six-cylinder military engine (LDT-465) was used to verify the aromatics vs NOx relationship obtained with the Onan motor-generator unit. GRA

N75-28254# Southwest Research Inst., San Antonio, Tex. Army Fuels and Lubricants Research Lab.
CRUDE OIL CHARACTERIZATION DATA PROGRAM Interim Report
E. A. Frame, E. C. Owens, and F. M. Newman Jul. 1974 50 p
(Contract DAAK02-73-C-0221)
(AD-A005076; AFLRL-35) Avail: NTIS CSCL 21/4

A computer program has been written which allows rapid retrieval and selection of CONUS and OCONUS crude oil characterization data. The computer program is conversational and permits use by personnel not experienced in computer operations. Crude oils are selected by using up to 14 categories of crude oil characterization data, including geographic location, production rate, reserves quantity and physical properties. GRA

N75-28255# Mathematical Applications Group, Inc., Elmsford, N.Y.
A FORMULATION OF HYDRODYNAMIC FLOW WITH MATERIALS THAT EXHIBIT ELASTIC PLASTIC BEHAVIOR: THE SMITE CODE Final Report, May - Dec. 1973
Samuel Z. Burstein, Harold S. Schechter, and Eli L. Turkel Aug. 1974 71 p refs
(Contract DAAD05-73-C-0512; DA Proj. 1T0-61102-A-33E)
(AD-A005580; MR-7057; BRL-CR-175) Avail: NTIS CSCL 19/4

This report describes a new formulation for an elastic-perfectly plastic computer code. The formulation uses a second order accurate integration method for numerically solving the governing partial differential equations. The algorithm uses an individual Eulerian grid for each material domain. These domains, which may be elastic, elastic-perfectly plastic, or purely hydrodynamic, are allowed to move freely through these grids communicating with each other through common interfaces; it is clear then that the boundaries of the domains are explicitly computed as part of the algorithm. GRA

N75-28256# Marquardt Corp., Van Nuys, Calif.
WATER ELECTROLYSIS PROPULSION SYSTEM TESTING Final Report, Oct. 1972 - Jul. 1974
John G. Campbell and R. Carl. Stechman, Jr. Nov. 1974 210 p
(Contract F04611-73-C-0006; AF Proj. 3058)
(AD-A004886; AFRPL-TR-74-72) Avail: NTIS CSCL 21/9

A twenty-four month program was conducted to demonstrate the life capability of a water electrolysis propulsion system and to develop flightweight 5-lbf and 0.1-lbf GO2/GH2 thrusters. A water electrolysis propulsion system was tested for 33 weeks at an accelerated rate to demonstrate its capabilities. The electrolysis unit experienced a loss of voltage on one cell after 19 weeks of testing. Design modifications and repairs were made after which an additional 14 weeks of testing were accomplished with no degradation in performance. The flightweight 5-lbf engine accumulated 152,015 pulses and 4.16 hours of firing demonstrating a steady state Isp of 355 seconds. The flightweight 0.1-lbf engine demonstrated a steady state Isp of 331 seconds while accumulating 301,726 pulses and 10.07 hours of firing time. GRA

N75-28257# Army Foreign Science and Technology Center, Charlottesville, Va.
INTERIOR BALLISTICS OF BORE SYSTEMS AND SOLID FUEL ROCKETS
M. E. Serebryakov 1 Feb. 1974 19 p Transl. into ENGLISH from the monograph "Vnulrennyaya Ballistika Stvolnykh Sistem i Porskhovykh Raket" Moscow, 1962 p 249-259, 305-310
(AD-A004918; FSTC-HT-23-2170-72) Avail: NTIS CSCL 21/8

Propellant grain geometries, burning singularities, advantages and disadvantages are discussed, slotted tube grains in particular detail. Requirements for igniters, several types of igniters,p(t)

pressure curves and formulas for calculating igniter weight are presented. Polysulfide, polyurethane rubber and polyhydrocarbon solid fuels, with and without addition of aluminum and magnesium and ammonium perchlorate as the oxidizer are discussed briefly. Increasing specific impulse by use of fluorine and the very light metals is discussed, data on specific impulse of several types of solid fuels are presented and comparative characteristics of solid fuel and liquid fuel launch engines are presented and discussed. Clustered engine systems and methods of assembly and outfitting large engines are listed briefly. GRA

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; and cryogenics.

N75-28258 Illinois Univ., Urbana.
LOW TEMPERATURE THERMAL CONDUCTIVITY MEASUREMENTS ON SOLID NEON AT CONSTANT VOLUME Ph.D. Thesis
Jim E. Clemans 1975 98 p
Avail: Univ. Microfilms Order No. 75-14095

The thermal conductivity of solid neon samples at constant volume was measured from 0.5 K to 10 K. An isotopically purified Ne-20 sample and a Ne-20 sample with 0.5% He-4 as well as a sample with the natural isotopic mixture was studied. These measurements were made at molar volumes between 13.4 cc/mole and 12.7 cc/mole. The enhancement of isotope scattering due to zero point effects was calculated to be between 25% and 150% using various theoretical estimates of the conductivity. Two conclusions were made independently of the theoretical approach, (1) the enhancement of scattering decreased with molar volume, and (2) the ratio of the enhancement for He-4 atoms in Ne-22 to that of atoms in Ne-20 is approximately 2. The high temperature thermal conductivity of the isotopically purified neon is observed to fall below that of natural neon of the same molar volume, in contradiction to the assumption that scattering processes are additive. Dissert. Abstr.

N75-28259 Oklahoma Univ., Norman.
COMPUTER MODEL FOR REGIONAL PLANNING OF WATER AND SEWER SYSTEMS Ph.D. Thesis
Robert Thornton Alguire 1974 199 p
Avail: Univ. Microfilms Order No. 75-15243

Six procedures were constructed which used three computer models: the inventory and data projection procedure which provides the input; the population model and procedure which generates the desirable alternatives in terms of people and their socio-economic characteristics; the land use procedure which allocates the output of the population model to an areal scheme; the demand model and procedure which produces the water demand and sewage output for the given areal scheme; the network model and procedure which optimizes on a least cost basis, while maximizing utilization of resources, the networks of water, and sewerage that fulfill the alternatives available; and the plan procedures for the development of a continuing and comprehensive plan. The steps between each procedure have built-in planner intervention points where the using group may game new alternatives based on the results and data acquired from the previous procedure. Dissert. Abstr.

N75-28260 Massachusetts Univ., Amherst.
STUDIES OF SUPERFLUID FILM PHENOMENA Ph.D. Thesis
Ephraim Bemis Flint 1974 143 p
Avail: Univ. Microfilms Order No. 75-6024

Experiments were performed which study the helium film flow oscillations that exist between two film coupled reservoirs. The film oscillations were monitored using a three terminal capacitance technique which measured the level in one reservoir as a function of time. These studies may be separated into two groups; experiments that studied the frequency and decay constant which decribes the film oscillations, and experiments that studied the velocity dependence of the film thickness. The first group of experiments measured the frequency and decay constant as functions of the geometry and the temperature between 1.2 K and the lambda point. The second group of experiments studied the frequency of the oscillations between 1.16 K and 1.6 K as a function of time to determine the velocity dependence of the film thickness. Dissert. Abstr.

N75-28261# Technische Universitaet, Munich (West Germany).
DETERMINATION OF THROUGH FLOWS AND COMPENSATION IN RESEVOIRS USING PROBABILITY THEORETICAL BASIS Ph.D. Thesis [ERFASSUNG VON DURCHFLUSS UND AUSGLEICH IN SPEICHERN AUF WAHRSCHEINLICHKEITSTHEORETISCHER GRUNDLAGE]
Theodor Leipold 12 Jul. 1974 81 p refs In GERMAN; ENGLISH summary
(Rept-15) Avail: NTIS HC $4.75

Problems in the derivation and application of probabilistic models for reservoirs are discussed. The investigations are made under the general assumption that the release is defined by a function of the state of the system and its input. Based on the analogy between reservoirs and queueing systems as well as on the connection between reservoirs and inventory systems -- which is made evident -- probabilistic models are derived and proved for various definitions of the system components. The interrelation between the different forms of the models is shown. Further investigations are dealing with the changes in the structure of the discharge caused by a reservoir and with general questions of the application and the interpretation of the basic model. Application of the analytical technique to realistic examples demonstrates its practical use. Author

N75-28262# National Bureau of Standards, Washington, D.C. Measurement Engineering Div.
SOME CUTTING EXPERIMENTS ON HUMAN SKIN AND SYNTHETIC MATERIALS Interim Report, Feb. - Aug. 1973
John R. Sorrells and Robert E. Berger Oct. 1973 71 p refs Sponsored in part by Consumer Prod. Safety Comm., Bethesda, Md.
(COM-75-10370/5; NBSIR-73-262) Avail: NTIS MF $4.25 CSCL 13L

Quantitative data used to establish and support toy safety regulations are presented along with test methods or devices which distinguish between hazardous and nonhazardous features of toys. Emphasis is placed on points, edges, and projections which are potentially dangerous under 'casual handling' conditions. The results of experimental cutting tests conducted on excised specimens of human skin with a variety of typical edges and within a limited range of controlled conditions are discussed. A method is described using synthetic materials as cut indicators to differentiate between hazardous and nonhazardous edges. GRA

32 COMMUNICATIONS

Includes land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Spacecraft Communications, Command and Tracking*.

N75-28263 British Broadcasting Corp., Kingswood (England). Engineering Div.
VIDEO DIGITAL FILTER STUDY 1: FIRST ORDER RECURSIVE FORM
J. O. Drewery Jan. 1975 22 p refs
(BBC-RD-1975/3; PH-134) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The theory and practice is described of using a particular kind of digital filter to process video signals. This filter behaves like a R-C integrator but its effect on the picture is associated with various types of resolution, namely horizontal resolution, vertical resolution, or temporal. Combinations are also discussed. The theory of the filter is developed and amplitude/frequency charcteristics, pulse response, pole plot, and quantization effects are discussed. Practical results are outlined. Author

N75-28264 British Broadcasting Corp., Kingswood (England). Research Dept.

DETERMINATION OF THE PHASE-CENTRE OF A UHF RUGGEDISED LOG-PERIODIC AERIAL IN THE H-PLANE
J. L. Riley Jan. 1975 7 p refs
(BBC-RD-1975/5; RA-136) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The phase-centre concept and the radiation pattern phase of a log-periodic aerial is discussed. Author

N75-28265 British Library Lending Div., Boston Spa (England).
EQUI-RIPPLE POLYNOMIALS AND SYNTHESIS OF 90 DEG COUPLERS
Fritz Arndt and Michael Hoffmann 15 May 1974 16 p refs Transl. into ENGLISH from Arch. Elektronik Ubertragungstechnik (West Germany), v. 26, no. 3, 1972 p 105-110
(BLL-RRE-Trans-427-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A simple method for determining equi-ripple polynomials is communicated and used for the synthesis of symmetrical broad band directional couplers. As an example the coupling coefficients of symmetrical 19 section 3 db, 8.34 db and seventeen section 20 db directional couplers are given in tabular form. It is further shown that symmetrical directional couplers with a coupling coefficient suitably continuously dependent along the coupling section show a high pass filter performance. Author

N75-28266 British Library Lending Div., Boston Spa (England).
SIGNAL INTEGRATION EFFICIENCY IN THE PRESENCE OF GROUND CLUTTER
A. M. Taraskin 15 May 1974 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektron (USSR), v. 16, no. 1, 1973 p 34-40
(BLL-RRE-Trans-433-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The processing of a coherent impulse signal with a large interpulse interval for optimum reception against background of internal noise is examined. The final expression enables the efficiency of signal integration in the presence of ground clutter to be evaluated approximately. Author

N75-28267 British Library Lending Div., Boston Spa (England).
PROBLEMS OF SYNCHRONIZATION IN DIGITAL COMMUNICATION SYSTEMS
M. Prehl 29 Aug. 1974 17 p refs Transl. into ENGLISH from Nachrichtentechnik Elektronik (East Germany), v. 3, 1974 p 90-93
(BLL-Trans-3147-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The development of an integrated digital communication system is presented. Low-frequency-channel pulse code modulation (PCM) systems are used to relieve conventional low-frequency space-multiple systems on low frequency subscriber cables. It is shown that if existing space-multiple exchanges are supplemented by PCM time-multiple coupling fields on the borders of adjacent tandem office areas, the following modifications can be obtained in the communication system: (1) increasing interconnection of local systems and, consequently, elimination of the hierarchy and relieving of trunk system; and (2) further integration of data and telephone systems through the benefits of the techniques of time-distributed transmission and exchange. The ultimate aim of this development is the complete organic integration of the data system into a purely time-distributed communication system. Network configurations are shown. Author

N75-28268 Syracuse Univ., N.Y.
APPLICATION OF OPTIMIZATION THEORY TO ELECTROMAGNETIC RADIATION AND SCATTERING Ph.D. Thesis
James Robert Stewart 1974 198 p
Avail: Univ. Microfilms Order No. 75-14028

Optimization methods are applied to the realm of wire antennas and scatterers. The method of steepest descent is compared with iterated and continued PARTAN. Continued PARTAN is developed as a basic method for general wire problems of arbitrary excitation and loading. Direct comparisons with matrix inversion are done with the pulse expansion for the current. The piecewise-sinusoidal expansion for the current with pulse testing for the fields is developed, giving improved accuracy with reduced number of subsections per wavelength. Computer time for calculating matrix elements is reduced by using the piecewise-sinusoidal expansion, and is further reduced by using Hertzian dipoles, where this approximation is valid. The flexibility of the optimization method is shown to be useful in a number of situations and a start is made on the problem of large systems. Other considerations unique to the optimization formulation, such as the initial choice for the current and suitable stopping criteria, are also discussed. Dissert. Abstr.

N75-28269 Syracuse Univ., N.Y.
THE DESIGN OF SIGNALS FOR EFFECTING FILTERING BY CEPSTRUM TECHNIQUES, WITH APPLICATION TO MULTIPATH CHANNELS Ph.D. Thesis
Wadie N. Sirgany 1974 156 p
Avail: Univ. Microfilms Order No. 75-14025

The use is discussed of the cepstrum for determining the distortion incurred by signals which have been transmitted over a dispersive channel. The problem is the design of signals which facilitate this determination for certain types of channel responses, (a simple multipath channel). Initial analysis is presented in terms of infinite sequences. The results are related to continuous-time signals (which describe the physical problems considered) and finite discrete analysis techniques (which allow direct computer implementation). To accomplish this, various definitions of real and complex cepstra were established, compared, and studied in detail. This includes modifications and extensions of previous developments to include practical considerations such as bandwidth and time-duration limitations. It is shown how a data sequence may be coded with practical signals which allow the easiest possible identification of the channel response by cepstral identification. Dissert. Abstr.

N75-28270 Pennsylvania Univ., Philadelphia.
ADAPTIVE ARRAYS FOR MICROWAVE IMAGING Ph.D. Thesis
Earl Norbert Powers 1974 154 p
Avail: Univ. Microfilms Order No. 75-14613

An approach is presented to the design of antennas based upon the use of thin, random, conformal, adaptive arrays. The adaptive system functions in such a way that the output signals from each array element are forced into phase alignment when the antenna is illuminated by a known source (a point source). Implicit in this criterion is the necessity for measuring the phase of the impinging wavefront at each point of the array. Phase measurement in turn implies that each element is provided with some type of phase reference against which the measurement can be made. An array module was developed and tested experimentally. This array module is frugal, and was shown to permit fabrication of a thin, random, conformal array whose performance agrees closely with theory. The experimental work confirmed the performance of the concept of a central processing array; it is believed that this technique can be used to fabricate the large antennas required for long wavelength imaging. Dissert. Abstr.

N75-28271 Rochester Univ., N.Y.
MAXIUMUM LIKELIHOOD RECEIVERS FOR NONLINEAR DIGITAL COMMUNICATION SYSTEMS Ph.D. Thesis
Isaac Ishola Ajewole 1975 192 p
Avail: Univ. Microfilms Order No. 75-15188

Nonlinear distortion in digital communication systems was studied. Maximum likelihood receivers (ML) were derived to combat any single valued nonlinearity and the normally present additive Gaussian noise. The ML receivers were derived for (1) binary transmission and adjacent intersymbol interference (i.s.i.); (2) M-ary transmission and the case in which there is i.s.i. form L sub p previous symbols and L sub f future symbols; and (3) based on the Viterbi algorithm, minimizing the probability of error over the entire message sequence. Performance of the receivers was obtained through computer simulation. It is observed that for all the receivers considered, the quadratic distortion degrades the performance more than either the error function (soft limiter) or cubic distortion. Dissert. Abstr.

N75-28272 California Univ., Los Angeles.
A UNIFIED APPROACH TO THE CONSTRUCTION OF CONSTANT FALSE ALARM PROBABILITY RADAR DETECTORS Ph.D. Thesis
Philip George Grieve 1975 269 p

Avail: Univ. Microfilms Order No. 75-14055

A unified approach to the construction of optimum constant false alarm probability (CFAP) radar detectors is provided. A CFAP radar detector is a detector for which the false alarm probability is known in advance to be a certain fixed value. Here an optimum CFAP detector is defined to mean a CFAP detector which has the largest possible detection probability for a given constant false alarm probability. The radar detection problem is reviewed and the need for CFAP detectors indicated. It is observed that CFAP detectors are equivalent to a class of well known statistical hypothesis tests. The optimum statistical theory for this class is then reviewed and it is found that the existing theory does not apply to all radar problems. Certain extensions of optimum statistical theory are obtained. These extensions enable the theory to be applied to most radar problems. Dissert. Abstr.

N75-28273 Missouri Univ., Rolla.
SURFACE ELECTROMAGNETIC WAVES WITH DAMPING. 1: ISOTROPIC MEDIA. 2: ANISOTROPIC MEDIA Ph.D. Thesis
Gary Shannon Kovener 1974 47 p
Avail: Univ. Microfilms Order No. 75-15831

Surface electromagnetic wave dispersion curves were calculated using a simple equation derived from Maxwell's equations and boundary conditions. Dispersion curves were obtained from attenuated total reflection measurements of silver. This result is extended to other materials and shows, that dispersion curves alone present an inadequate summary of the data. Dissert. Abstr.

N75-28274 North Carolina State Univ., Raleigh.
A NEW METHOD OF DETERMINING THE PERFORMANCE OF DELTA MODULATION SYSTEMS Ph.D. Thesis
William Clay Adams, Jr. 1974 94 p
Avail: Univ. Microfilms Order No. 75-15928

A formula for signal to quantizing noise ratio in delta modulation systems is derived assuming only stationarity of the signal source. The three interesting terms in this expression are examined as a function of quantizing step size the relative sampling rate for three types of signal inputs. Computer simulation is used to obtain empirical results concerning the behavior of the three terms and a qualitative explanation for this behavior is offered. The analysis is undertaken from a total quantizing noise point of view; this gives an insight into system behavior that cannot be obtained by considering the effects of the signal-correlated and signal-uncorrelated components of quantizing noise separately. The entropy of the output of three adaptive source encoders, A delta M, APCM and ADPCM, is measured for speech input at low sampling rates. It is attempted to correlate the source encoder output entropies, normalized to the channel bit rate, with the results of informal listening tests. Dissert. Abstr.

N75-28275 North Carolina State Univ., Raleigh.
THE INPUT ADMITTANCE QUALITY FACTOR AND RELATIVE BANDWIDTH OF THE RECTANGULAR CAVITY-BACKED SLOT ANTENNA Ph.D. Thesis
Capers Rembert Cockrell 1974 176 p
Avail: Univ. Microfilms Order No. 75-15919

Equations which represent the magnetic and electric stored energies are derived for an infinite section of rectangular waveguide and a rectangular cavity. These representations which are referred to as being physically observable were obtained by considering the difference in the volume integrals appearing in the complex Poynting theorem. It is shown that these physically observable stored energies were determined by the field components that vanish in a reference plane outside the aperture. These representations were used to compute the input admittance of a rectangular cavity-backed slot antenna in which a single propagating wave is assumed to exist in the cavity. For the rectangular cavity-backed slot antenna, the Q and relative bandwidth were computed independently by using energy relationships. It is shown that the asymptotic relationship which is usually assumed to exist between the Q and the reciprocal of relative bandwidth is equally valid for the rectangular cavity-backed slot antenna. Dissert. Abstr.

N75-28276 Missouri Univ., Columbia.
SIGNAL CORRELATION TECHNIQUES APPLIED TO FM FAULT LOCATION Ph.D. Thesis
Danai Milindavanij 1974 223 p
Avail: Univ. Microfilms Order No. 75-16029

A comprehensive discussion is provided on the propagation characteristics of a periodic linear FM signal which is used as the transmitted carrier in a power transmission line fault locator utilizing the principles of FM radar. The analysis is done mostly in the frequency domain and exploits the properties of practical overhead transmission lines which are shown to be approximately distortionless when operated at sufficiently high frequency. A digital computer program which simulates a two-wire transmission line in detail is used for reflection analysis of both ideal and real transmission lines with various terminating conditions. Correlation and cepstrum techniques which can be used to extract line length information from the composite (transmitted plus reflected) signal at the sending end are derived. Field test results which exhibit substantial agreement with the theoretical conclusions are presented. Suggestions are provided for further development of the fault locator. Dissert. Abstr.

N75-28277 Catholic Univ. of America, Washington, D.C.
RANDOM CODING APPLIED TO MULTIDIMENSIONAL SIGNAL DESIGNS Ph.D. Thesis
James William Linnehan, Jr. 1974 163 p
Avail: Univ. Microfilms Order No. 75-13950

Random coding was applied for the first time to the analysis of a general class of multidimensional signal designs. The signal class includes all existing digital modulation techniques and is developed as a frequency and time plane made up of individual frequency/time cells. Each cell is modulated by a discrete amplitude and phase. This model of the signal structure is described in terms of a real vector space, in which the dimensionality depends on the frequency, phase, and time delay of the signal set. The communication channel is the discrete, coherent, additive white Gaussian noise channel. The M-ary modulation techniques and analysis are based on a single use of the communication system to send one of M messages. Random coding estimates what maximum information rate is possible if a message is represented as a sequence or combination of M-ary symbols. The actual construction of a set of sequences, code words, is not specified by this approach, but the existence of a set which can achieve the maximum rate is guaranteed. Dissert. Abstr.

N75-28278*# Ohio Univ., Athens. Avionics Engineering Center.
COMMON ANTENNA PREAMPLIFIER-ISOLATOR FOR VLF-LF RECEIVERS
R. W. Burhans Jul. 1975 6 p
(Grant NGR-36-009-017)
(NASA-CR-143237; TM-17) Avail: NTIS HC $3.25 CSCL 17B

A modified high impedance preamplifier circuit which provides outputs to drive an Omega-VLF receiver and an ADF-LF receiver from a common antenna on general aviation aircraft is reported. The preamplifier was evaluated with fixed ground station receivers and results show the burn out problem of the first stage MOSFET during very close lightning discharges was eliminated. Author

N75-28279*# Ohio State Univ., Columbus. ElectroScience Lab.
ATS-6 MILLIMETER WAVELENGTH PROPAGATION EXPERIMENT Quarterly Report, 15 Jan. - 14 Apr. 1975
D. B. Hodge and D. M. Theobold Jun. 1975 14 p refs
(Contract NAS5-21983)
(NASA-CR-143814; ESL-3863-5) Avail: NTIS HC $3.25 CSCL 17B

An empirical relation for path diversity gain as a function of terminal separation distance and single site fade depth is presented. This relation is based on existing 15.3 GHz ATS-5 attenuation data and 16.0 GHz radiometric temperature data for earth-space propagation paths. Preliminary 30 GHz ATS-6 diversity data are presented and are found to agree well with this empirical relation. Author

N75-28280*# Texas Instruments, Inc., Dallas. Equipment Group.
AIRBORNE ELECTRONICALLY STEERABLE PHASED ARRAY Final Report
Robert Coats Apr. 1975 88 p refs
(Contract NAS8-25847)
(NASA-CR-120665; DM75-05-10) Avail: NTIS HC $4.75 CSCL 17B

Results of a study directed to the design of a lightweight high-gain, spaceborne communications array are presented. The array includes simultaneous transmission and receiving, automatic acquisition and tracking of a signal within a 60-degree cone from the array normal, and provides for independent forming of the transmit and receive beams. Application for this array is the space shuttle, space station, or any of the advanced manned (or unmanned) orbital vehicles. Performance specifications are also given. Author

N75-28281# Centro de Investigaciones Fisicas (Leonardo Torres Quevedo), Madrid (Spain).
RF CHARACTERISTICS OF A DEPLOYABLE ANTENNA FOR SATELLITES: COMPUTER PROGRAM MANUAL
[1975] 119 p refs Prepared for Messerschmitt-Boelkow-Blohm
(Contract ESTEC-2070/73-HP)
(ESRO-CR(P)-645-b) Avail: NTIS HC $5.25

A computer program to supply RF characteristics of an antenna which, as a consequence of its work conditions, can become mechanically distorted, is described together with its associated subroutines. The radiant system is presented in order to know the possibilities of the program. The antenna includes as reflective surface a paraboloid of revolution fed by three horns placed around its focus. In the case of a deployable antenna, the reflector has mechanically two different parts: the rigid central disk (diameter = 1.70 m) which apart from thermal distorsions can be considered undistorted, and the deployable part consisting of twelve radial ribs supporting a reflecting wire grid, which are folded until the satellite becomes operational in its orbit. The system works as a multibeam one with three horns as feeders that emit with circular polarization in the lambda equals 2.5cm. Foreseen distortions refer both to the reflectors and to the system of horns. ESRO

N75-28282# Centro de Investigaciones Fisicas (Leonardo Torres Quevedo), Madrid (Spain).
STUDY ON DEPLOYABLE ANTENNAS FOR SATELLITES. SHADE PROBLEM WHEN THE HORN IS OUT OF FOCUS
[1975] 13 p Prepared for Messerschmitt-Boelkow-Blohm
(Contract ESTEC-2070/73-HP)
(ESRO-CR(P)-645-C) Avail: NTIS HC $3.25

To study the influence of feed systems supports on RF characteristics, some simplifying hypotheses were made aiming at a degradation of those characteristics greater than that of the actual antenna. The shade zone can be generated due to direct beams projecting on the paraboloid, the shade of the support illuminated from the horn, or due to beams coming from the horn which, after being reflected by the parabolic surface, are intercepted by the support. Two different subroutines were prepared to determine, in both cases, the coordinates of the emitter point and the director cosinus of the considered direction to see whether or not it cuts the support cylinder. The intersection of a beam with the support cylinder or with the central disk where the horns are placed was investigated. Results are presented for an ideal parabolic shape antenna showing the shades produced by the horn support in the case of an out of focus antenna. ESRO

N75-28283# Defense Communications Engineering Office, Reston, Va.
DCS SYSTEM CONTROL CONCEPT FORMULATION
D. Schutzer, V. Grace, O. Halpeny, and F. Ricci Feb. 1974 73 p refs
(AD-A005495; TR-5-74A) Avail: NTIS CSCL 17/2

The report provides the conceptual framework for the design of the DCS system control subsystem for the early 1980's and is intended to serve as the conceptual baseline for this design. The report includes a summary of guidance provided, the system control objectives, the subsystem conceptual structure, the operational concept, and transition considerations. An appendix is included containing summary information on various commercial digital transmission systems which were reviewed during the preparation of this report. GRA

N75-28284# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
POWER SUPPLY RIPPLE EFFECTS ON A NEAR CARRIER TRANSMITTED SPECTRUM
Thomas A. Barley and Gustaf J. Rast, Jr. 6 Jan. 1975 44 p refs
(AD-A005560; RE-75-11) Avail: NTIS CSCL 17/9

The transmitter discussed is for the Experimental Array Radar program. It consists of one Hughes 634H/5 traveling wave tube amplifier, appropriate power supplies, and microwave signal processing components. The Hughes 634H/5 traveling wave tube amplifier is a pulsed tube operating in full beam current cutoff mode. The basic conceptual designs dictating the advanced configuration evolve from a requirement to maintain rigid phase coherence between the continuous wave radio frequency input signal to the traveling wave tube amplifier and the individual cycles of radio frequency signal in the amplified pulse output from the traveling wave tube amplifier. This places stringent requirements on the allowable ripple which the various tube element power supplies may possess. GRA

N75-28285# Harris Corp., Melbourne, Fla. Electronic Systems Div.
MULTIPLE TARGET INSTRUMENTATION RADAR, PHASE 2 Bimonthly Report, Nov. - Dec. 1974
Duane E. Bower 31 Oct. 1974 21 p refs
(Contract N00014-75-C-0033)
(AD-A005522; JA-1543-2; BMR-2) Avail: NTIS

The objective of the present study is to develop the logic for the Radar Operating Procedure (ROP), and implement a system simulation to verify the effectiveness of the design. GRA

N75-28286# Institute for Telecommunication Sciences, Boulder, Colo.
ANALYSIS OF PROBLEMS IN THE APPLICATION OF RADAR SENSORS TO AUTOMOTIVE COLLISION PREVENTION. EXECUTIVE SUMMARY Final Report, Jan. 1974 - Jan. 1975
R. A. Chandler, L. E. Wood, and L. A. Jacobson Mar. 1975 27 p refs
(Contract DOT-HS-4-00813)
(PB-240733/6; DOT-HS-801-453) Avail: NTIS HC $3.75 CSCL 13E

The report describes the results of the second phase of an investigation of the practicality and technical feasibility of using radar sensors for automatic automotive braking systems. Radar signatures of typical vehicular targets at 35 GHz and 60 GHz are shown. Tracking radar systems and their feasiblity in the automotive application are discussed with respect to the problem of potentially high false alarm rates caused by highway curves. The problem of intersystem blinding is considered in depth, and estimations are made of the effectiveness of polarization isolation and frequency-hopping in reducing blinding efforts. The performance of diplex radar systems in blinding configurations is discussed. Preliminary specifications are recommended as guidelines for judging the acceptability of prototype systems for marketing. GRA

N75-28287# Utah Univ., Salt Lake City. Dept. of Computer Science.
SELECTED METHODS FOR IMPROVING SYNTHESIS SPEECH QUALITY USING LINEAR PREDICTIVE CODING: SYSTEM DESCRIPTION, COEFFICIENT SMOOTHING AND STREAK
Steven Frank Boll Nov. 1974 67 p refs
(Contracts DAHC15-73-C-0363; F30602-70-C-0300; ARPA Order 2477)
(AD-A004973; UTEC-CSC-74-151) Avail: NTIS CSCL 17/2

This report develops two generalizations of the standard Linear Predictive Coding (LPC) implementation of a narrow band speech compression system. The purpose of each method is to improve the speech quality that is available from a standard LPC system.

Attention is focused primarily upon the pitch excited system and therefore, the improvements considered focus upon the improved estimation of the reflection coefficients and the pitch period. Specifically, a parameter filtering algorithm is developed for dynamically smoothing the reflection coefficients to both increase naturalness in synthetic speech as well as eliminate the possibility of synthesis filter instabilities. Secondly, a new method for calculating the k-parameters of an LPC inverse filtering algorithm is developed, STREAK. GRA

N75-28288# Georgia Inst. of Tech., Atlanta. Engineering Experiment Station.
ENVIRONMENT AND RADAR OPERATION SIMULATOR Quarterly Report, 21 Jun. - 30 Sep. 1974
S. N. Cole and R. C. Michelson Dec. 1974 53 p refs
(Contract DAAB07-74-C-0272; DA Proj. 1S7-62703-DH-93)
(AD-A005058; GIT-A-0272-1; ECOM-74-0272-1; QR-1) Avail: NTIS CSCL 17/9

The report summarizes activities directed toward the design and fabrication of an Environment and Radar Operation Simulator (EROS). The purpose of the simulator is to reduce the cost of environmental testing by providing an accurately synthesized facsimile of radar backscatter from targets and clutter. A feasibility model of an EROS system is being developed under this project for the AN/PPS-15 radar. However, the EROS design is strongly influenced by the long-range goals of developing an EROS with sufficient flexibility to simulate radar backscatter from a broad range of radar types. GRA

N75-28289# Radio Corp. of America, Moorestown, N.J. Government and Commercial Systems.
THE TSAR SEARCH AND TRACK COMPUTER Final Report, 2 Apr. 1973 - 31 Jun. 1974
Henry M. Halpern, Richard J. Smith, and Leonard Weinberg Jan. 1975 184 p
(Contract F30602-73-C-0233; AF Proj. 6512)
(AD-A005675; RADC-TR-74-348) Avail: NTIS CSCL 17/9

This report summarizes work done to provide a control computer for a proposed time scanned array radar (TSAR). The radar is a long range surveillance and tracking radar steered in one coordinate by modifying the signal. This effort resulted in the selection of a minimum cost minicomputer and providing many of the key programs to drive the radar. A General Automation SPC 16/65 was selected as the mini after a tradeoff of several similar types. The computer was purchased and found to be very satisfactory. The software developed provides a scheduler, a search pattern and up to ten simultaneous tracks. The elliptical search fence is scanned in 2.33 seconds. The time to search increases to 3.5 seconds with six simultaneous tracks. A target simulator was also provided. Lost track and power tailoring algorithms were also studied. GRA

N75-28290# Philco-Ford Corp., Willow Grove, Pa. Radio Transmission Equipment Engineering Lab.
MICROWAVE DATA TRANSMISSION TEST PROGRAM: QUATERNARY BASEBAND MODEM Final Report, Mar. 1973 - Feb. 1974
Robert J. Donzelman, Christopher A. Miedzius, Norman G. Jones, and Benjamin Levesky Dec. 1974 69 p
(Contract F30602-73-C-0203)
(AD-A005686; RADC-TR-74-319) Avail: NTIS CSCL 17/2

The objective of the microwave data transmission test program - Quaternary baseband modem was to design, construct and conduct system tests on a quaternary baseband modulator/demodulator (Modem). The modem is designed to permit the passage of digital data traffic over conventional frequency division multiplex radios with baseband interface. Data rates from 1.536 Mbps to 12.95 Mbps, in 1 Kbps increments, can be accommodated by the QPSK Modem. This program was performed concurrently with a program to develop a modem with an IF interface (QPSK Modem). Of particular interest are the system test results, including bit error rate as a function of received signal level and transmitted spectral occupancy. GRA

N75-28291# Massachusetts Univ., Amherst. Engineering Research Inst.
ANALYSIS OF HYBRID TRACKING LOOP FOR BINARY PHASE-SHIFT KEYING M.S. Thesis
William L. Schweber Jul. 1974 65 p refs
(Grant AF-AFOSR-2111-71; AF Proj. 9769)
(AD-A005713; AFOSR-75-0179TR) Avail: NTIS CSCL 17/2

A Hybrid Tracking Loop (HTL), combining features of the phase-lock loop and Costas loop, is examined. The HTL is analyzed for the case of binary phase-shift keyed modulation, and the linear, small error approximation is used, which permits an analysis of performance with arbitrary loop filters. The rms jitter is determined as a function of the loop parameters. For the case where the various loop filters are the same, results of the jitter analysis are greatly simplified, and a simple scheme for canceling the major source of jitter becomes apparent. This cancellation scheme is examined in greater detail, and compared to results obtained with a wide variety of values for loop parameters. GRA

N75-28292# GTE Sylvania, Inc., Needham Heights, Mass. Electronic Systems Group.
MEGABIT DIGITAL TROPOSCATTER SUBSYSTEM (MDTS) Semiannual Report, Jun. - Nov. 74
Charles Benavides, J. W. Graham, Dale R. Kern, and P. Monsen Dec. 1974 87 p refs Prepared in cooperation with Signatron, Inc., Lexington, Mass.
(Contract DAAB07-74-C-0040; DA Proj. 1X7-64701-D-149)
(AD-A005290; ECOM-0040-2-74; SAR-2) Avail: NTIS CSCL 17/2

The primary objective of the MDTS is to produce a wideband digital data modem and appropriate link modifications to convert established DCS troposcatter links from analog to digital operation. The MDTS program provides for the design, development, fabrication, and test of eight engineering models of the modem. Established MDTS modem throughput data rates are 1.544 Mbps, 3.088 Mbps, 6.276 Mbps over path lengths up to 250 N Miles and 9.1414 Mbps, 12.962 Mbps over path lengths up to 150 N Miles. GRA

N75-28293# Gaertner Research, Inc., Stamford, Conn.
DEVELOPMENT OF BUILT-IN-TEST EQUIPMENT FOR TACTICAL FM RADIOS Final Report, 13 Jun. 1972 - 1 Mar. 1974
W. W. Gaertner, L. Fiore, and C. Copp Sep. 1974 161 p
(Contract DAAB07-72-C-0238; DA Proj. 1S7-62705-AH-94)
(AD-A005277; ECOM-72-0238-F) Avail: NTIS CSCL 17/2

The objective of the R and D Program was to verify the conceptual feasibility of modular maintenance by developing a capability whereby the repair of an end item in the field would be by module replacement only, without the need for sophisticated test equipment and with minimum personnel training. Thus, Direct Support Maintenance, for example, would be reduced primarily to module replacement which would be carried out by the operator, a member of a maintenance contact team or other designated personnel. The use of the AN/PRC-77 Radio Set as a vehicle for this effort was done so primarily because it imposed severe design constraints on the resultant BITE circuitry, particularly in the areas of size, weight and power consumption. Circuitry and techniques were developed wherein fault isolation was demonstrated to a replaceable module level with a power consumption budget of only 43mW of standby power, and 21 OmW required during the fault locate routine. GRA

N75-28294# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala. Advanced Sensors Directorate.
DESIGN AND OPERATION OF AUTOMATIC GAIN CONTROL (AGC) FOR AREST RECEIVER
W. Allen Cochrane and William G. Briscoe Aug. 1974 35 p refs
(DA Proj. 1M2-62303-A-214)
(AD-A005153; RE-75-8) Avail: NTIS CSCL 17/9

The receiver for the Advanced Radar Experimental Systems Technology (AREST) is discussed. Functions of the receiver and basic specifications are given. The operation and design of the Automatic Gain Control (AGC) Circuit is described in detail. GRA

N75-28295# Army Electronics Command, Fort Monmouth, N.J.
USE OF INTEGRATED CIRCUITS AND SILICON SEMICON-

DUCTORS IN RADIO SET AN/PRC-77
Dieter R. Lohrmann Feb. 1975 64 p
(AD-A005223; ECOM-4291) Avail: NTIS CSCL 17/2

Under the various requirements and restrictions, use of integrated circuits and silicon transistors in the AN/PRC-77 was investigated. A model of the AN/PRC-77 using such components was designed, fabricated, and tested. All new modules are usable interchangeably in any combination with the old ones. If adopted, a reduction of production cost by approximately $15 per set, and an increase in reliability should result. Also, silicon semiconductors are more modern than the Germanium components now being used and there is no uncertainty about their availability at low cost in the foreseeable future. GRA

N75-28296# Transportation Systems Center, Cambridge, Mass.
MEASUREMENT AND ANALYSIS OF L-BAND (1535-1660 MHz) ELECTROMAGNETIC (EM) NOISE ON SHIPS Final Report, Nov. 1972 - Oct. 1973
J. M. Clarke, S. R. Cantor, J. J. Winchus, and A. L. Caporale Dec. 1974 81 p refs
(AD-A005653; DOT-TSC-USCG-74-3; USCG-D-50-75) Avail: NTIS CSCL 17/2

A program of L-band (1535-1660 MHz) electromagnetic (EM) noise measurements conducted on ships is described. The magnitude and duration of EM noise on ships is of particular significance in terms of potential radio frequency interference (RFI) to future Marine Satellite (MARSAT) receiving systems of ships. The program involved the measurement and identification of EM noise levels originating at internal sources on the ships selected, and external sources at coastal locations within radio line-of-sight. The instrumentation and measurement procedures employed are described and illustrated. GRA

N75-28297# Boeing Aerospace Co., Seattle, Wash.
EMP ISOLATION PROVIDED BY LARGE FARADAY-SHIELDED TRANSFORMERS Final Report
Dec. 1974 169 p
(Contract DACA87-72-C-0002)
(AD-A005620; TM-82) Avail: NTIS CSCL 15/3

The pulse response of a variety of power transformers was determined, with emphasis on Faraday-shielded transformers. Tests were conducted on seven transformers and an Inductrol regulator at the SAFEGUARD North Dakota site. The transformers range in size from 10 MVA to 250 VA. The analysis program used the test results to the transformer characteristics, and to calculate the shielding effectiveness of the transformers for a variety of input conditions, loads, and wiring configurations.
Author (GRA)

N75-28298# Radio Corp. of America, Moorestown, N.J. Missile and Surface Radar Div.
TIME SCANNED ARRAY RADAR CONTROL GENERATOR Final Report, 5 Apr. 1973 - 5 Apr. 1974
George A. Senior Jan. 1975 50 p
(Contract F30602-73-C-0230)
(AD-A005676; RADC-TR-74-338) Avail: NTIS CSCL 17/9

An Experimental Model of a control generator was built as a component of an experimental phased array radar. The output signals comprise a sequence of low-power r-f pulses accurately controlled in pulse to pulse phase shift and timing. Duration of the pulse sequence, phase shift and sub pulse spacing is controllable by command from a digital computer. The generator will be used in bench tests with other components of the transmitter system to simulate a Time Scanned Array Radar operation. GRA

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N75-28299 British Library Lending Div., Boston Spa (England).
INTEGRATED CIRCUITS: SENSITIVITY TO AND PROTECTION AGAINST EXCESSIVELY HIGH VOLTAGES
J. Iseli 11 Nov. 1974 15 p refs Transl. into ENGLISH from Polytech. Tijdschrift, Elektrotechniek, Electronica (Switzerland), v. 27, no. 9, 1972 p 671-676
(BLL-Trans-3160-(9022.81)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Static and dynamic overvoltage sensitivity of integrated circuits during industrial use is examined along with circuits and devices designed to protect them. Tests were made on circuits from the transistor-transistor-logic family. It was found that quick acting limiting switch and short circuiting arrangements constitute the only reliable protection. E.H.W.

N75-28300 Idaho Univ., Moscow.
DESIGN OF RELIABLE ASYNCHRONOUS SEQUENTIAL MACHINES Ph.D. Thesis
Dwight Holden Sawin, III 1974 116 p
Avail: Univ. Microfilms Order No. 75-15482

A number of design procedures for self-testable circuits are developed. The fault conditions are those where inputs or outputs of gates assume a stuck-at-1 (s-a-1) or stuck-at-0 (s-a-0) state. Included is the situation where all or part of a feedback path becomes s-a-1 or s-a-0. This case is of extreme importance since, due to the nature of an asynchronous machine and its feedback capabilities, a single fault can cause failures in several internal state variables. The class of faults detected can easily be extended to a much greater range once the detection scheme employed here is understood. The fault detecting circuits are derived via a systematic approach yielding a machine which, under fault conditions, assumes an easily recognizable state, hence the self-testing aspect. Dissert. Abstr.

N75-28301 California Univ., Davis.
ON THE FREQUENCY WEIGHTED LEAST SQUARE DESIGN OF FINITE DURATION FILTERS Ph.D. Thesis
Minsoo Suk 1974 226 p
Avail: Univ. Microfilms Order No. 75-15462

In both one and two dimensions, Fredholm integral equations form the basis of the design of continuous filters. Solutions of these integral equations are expressed in series form using prolate spheroidal functions as basis functions. An iterative solution of the integral equations based on the Neumann series is also developed. For the discrete filter design, optimal filters are found conveniently by matrix inversion technique. Specifically, for FIR digital filters, an efficient Toeplitz matrix inversion procedure in one dimension, and a vector Toeplitz inversion procedure in two dimensions is employed. A design technique using one or several building blocks which approximate an arbitrary frequency response is suggested, and the possibilities of this technique are explored. As an example, the digital interpolation of images, demonstrating an application of two dimensional filters, was performed. Dissert. Abstr.

N75-28302 Yale Univ., New Haven, Conn.
SURFACE STATES IN THICK-OXIDE MOS TUNNEL JUNCTIONS Ph.D. Thesis
Tso-ping Ma 1974 160 p
Avail: Univ. Microfilms Order No. 75-15332

Theoretical and experimental measurements on a particular type of semiconductor structure and the surface-state spectra over the entire band gap of the semiconductor by a modified ac conductance technique is presented. The validity and the limitation of the technique is discussed using a reduced equivalent circuit representation. The effect of gamma-ray irradiation on the surface properties of semiconductor junctions was investigated. Results indicate that the gamma-ray irradiation produces no significant change of the characteristics of semiconductor junctions. A systematic room temperature bias experiment was conducted to investigate the effect of gate metal on the surface states of semiconductor junctions. The results show that the metal reacts with the SiO2 layer electrochemically and diffuses into the silicon oxide structure, thus forming positive charge centers, which induce new surface states at the SiO2- Si interface. Dissert. Abstr.

N75-28303 Washington Univ., Seattle.
ANOMALOUS BEHAVIOR OF TRANSISTOR-TRANSISTOR LOGIC CIRCUITS WITH TOTEM-POLE OUTPUT Ph.D. Thesis
Ramaswamy Srinivasan 1974 215 p
Avail: Univ. Microfilms Order No. 75-14937

The response of transistor-transistor logic (TTL) gates, with totem-pole output, for input conditions which are in the logically undefined region, is studied experimentally and analytically. The phase splitter and the totem-pole configuration in these circuits are such that they exhibit Schmitt trigger action due to positive feedback over a range of input conditions. This anomalous behavior results in hysteresis loops in the static input, output and transfer characteristics of these gates. Analytical procedures are followed to determine the magnitude of the hysteresis width as well as the actual static input and transfer characteristics. Experimental observations show that the hysteresis width has increased as the circuits were modified from one generation to the other for better speed. Dissert. Abstr.

N75-28304 Missouri Univ., Rolla.
RC-GYRATOR LADDER AND RLC SYMMETRICAL LATTICE NETWORK SYNTHESIS: A STATE-SPACE APPROACH Ph.D. Thesis
Tien Hua 1974 126 p
Avail: Univ. Microfilms Order No. 75-15825

Two network realization procedures using the state-space approach are presented. The first procedure is the realization of a transfer function. A state model (A,B,C,D) was obtained from the given transfer function by inspection, where A is a companion matrix. Through a similarity transformation T, another state model (F,G,H,J) was obtained, where F is a tridiagonal matrix and can be realized by a RC-gyrator ladder network. The input source was inserted in the proper position of the ladder network, and the output was obtained through a summing circuit. It is a minimal realization. The second procedure is the realization of an A matrix with a symmetrical lattice network. It is shown that the network functions of a symmetrical lattice network have a common factor in their numerators and denominators. The eigenvalues of the A matrix are the poles and zeros of the driving point functions. The synthesized network that consists of RC, RL, LC, or RLC elements depends on the locations of the eigenvalues of A. It is not a minimal realization. Dissert. Abstr.

N75-28305 Missouri Univ., Rolla.
STATE-SPACE ANALYSIS AND SYNTHESIS OF ACTIVE RLC NETWORKS Ph.D. Thesis
Wen-Pao Lee 1974 250 p
Avail: Univ. Microfilms Order No. 75-15832

Theoretical foundations are presented for the state-space analysis and synthesis of linear active RLC networks containing all four types of controlled sources. The analysis portion is concerned with an explicit representation of the state model and the order of complexity of a general linear active RLC network. The problem considered in the synthesis portion is the realization of a given A-matrix with an active nondegenerate RLC-ladder network or an active RLC network without any particular structure. The general active RLC network state model representations are explicitly expressed in terms of the fundamental circuit submatrices, the network element submatrices, and the dependency submatrices. An algorithm using a unified procedure for evaluating the least upper bound of the order of complexity of a general linear active network is presented. Derivation of this algorithm is based upon the transformation of the original network into an equivalent network containing only resistors, inductors, capacitors, and controlled sources. Dissert. Abstr.

N75-28306 Missouri Univ., Columbia.
NONLINEAR TRANSIENT STABILITY ANALYSIS OF INDUCTION MOTOR VIA SECOND METHOD OF LIAPUNOV Ph.D. Thesis
Yasuhiko Dote 1974 109 p
Avail: Univ. Microfilms Order No. 75-15987

A transient stability analysis of a three phase induction motor was performed by applying the second method of Liapunov to the equations which describe the dynamic behavior of the ideal induction motor. A unique transformation was made resulting in a simplified system of equations to which the second method of Liapunov is applicable. Then in the determination of the stability region, a simple method is presented using the specific nature of the nonlinearities (terms involving the product of two state variables). The asymptotic stability region which was obtained is a region of stability in the large. This region is larger than the local region of stability resulting from linearization about the steady state operating point. Dissert. Abstr.

N75-28307 Missouri Univ., Rolla.
PARAMETER IDENTIFICATION OF NONUNIFORM DISTRIBUTED RC NETWORKS Ph.D. Thesis
Roger Allen Hayes 1974 80 p
Avail: Univ. Microfilms Order No. 75-15822

Sufficient conditions are presented to insure a unique solution to the parameter identification problem. One theorem requires the knowledge of a driving-point impedance, the knowledge of the physical length, and the constraint that the r(x)c(x) product remains constant to insure uniqueness of the parameters r(x) and c(x). Relaxation of the r(x)c(x) product constraint allows for other combinations of r(x) and c(x) which produce identical terminal characteristics, thus destroying the uniqueness property. However, knowledge of a driving-point impedance, of the physical length, and of r(x) is sufficient to uniquely determine c(x). A practical parameter identification routine is then presented in order to find the unknown parameters. A Fletcher-Powell/Davidon unconstrained minimization technique is used although any routine with appropriate convergence properties may be utilized. Examples of parameter identification of known networks are given. Dissert. Abstr.

N75-28308 Arizona Univ., Tucson.
PROBLEMS IN THE DESIGN AND FABRICATION OF UNI-JUNCTION TRANSISTORS BY PLANAR TECHNOLOGY Ph. D. Thesis
Edwyn Darwyn Smith 1974 119 p
Avail: Univ. Microfilms Order No. 75-14210

Numerous unijunction transistor (UJT) devices, fabricated by conventional planar technology from nominal 100 ohm-cm n-type silicon, yielded measured results quite irreconcilable with those predicted by a simple model. Three major considerations are identified. (1) Thermal oxidation produced a substantial positive surface potential; the resultant surface conductance is an important contributor to the current flow and invalidates any simple 'resistance' model. (2) Typically, diffusions designed to produce light-heavy (L-H) 'junctions' are considered prerequisite to the formation of satisfactory ohmic contacts to lightly doped material. (3) Planar-diffused n-type L-H 'junctions,' if sufficiently abrupt, exhibited avalanche breakdown when biased as an exit contact; breakdown was never observed to occur when biased as an entrance contact. A p-n junction guard ring surrounding an n-type L-H 'junction' was conceived of as a composite base one contact. Dissert. Abstr.

N75-28309 Washington Univ., Seattle.
BLOCK COUPLER/DIRECTIONAL COUPLER FOR HYBRID INTEGRATED OPTICAL CIRCUIT Ph.D. Thesis
Hui-Pin Hsu 1974 213 p
Avail: Univ. Microfilms Order No. 75-14922

An analysis of the block coupler, consisting of either two identical or two dissimilar planar dielectric waveguide sections placed face to face, is presented. The coupling mechanisms of the block coupler with and without additional phase matching grating are studied separately. The performance of the coupler is analyzed in terms of the parameters of the constituent waveguides. The degradation of the performance of the coupler caused by different mechanisms is investigated. The design tolerance for block couplers is evaluated theoretically. Dissert. Abstr.

N75-28310 Utah State Univ., Logan.
ASYNCHRONOUS LOGIC DESIGN WITH FLIP-FLOP CONSTRAINTS Ph.D. Thesis
David Franklin Cox 1974 121 p
Avail: Univ. Microfilms Order No. 75-14422

Some techniques are presented to permit the implementation of asynchronous sequential circuits using standard flip-flops. An algorithm is presented for the RS flip-flop, and it is shown that any flow table may be realized using the algorithm (the

flow table is assumed to be realizable using standard logic gates). The approach is shown to be directly applicable to synchronous circuits, and transition flip-flops (JK, D, and T) are analyzed using the ideas developed. Constraints are derived for the flow tables to meet to be realizable using transition flip-flops in asynchronous situations, and upper and lower bounds on the number of transition flip-flops required to implement a given flow table are stated. Dissert. Abstr.

N75-28311 British Library Lending Div., Boston Spa (England).
MATHEMATICAL INVESTIGATIONS CONCERNING THE EFFECT OF ALTERNATING CURRENT ON CORROSION
J. Dovay and L. Moszaros [1974] 6 p Transl. into ENGLISH from Acta. Chim. (Hungary), v. 44, 1965 p 397-402
(BLL-M-Trans-23645-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The possibility is discussed of describing anodic and cathodic processes occurring on homogeneous metal surfaces by using Tafel equations. The results of the calculation are given. Author

N75-28312+ Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
ACTIVE COMPONENTS FOR INTEGRATED OPTICS: STUDY OF A FAST PHOTODETECTOR Final Report [COMPOSANTS ACTIFS POUR L'OPTIQUE INTEGREE. ETUDE D'UN PHOTODETECTEUR RAPIDE]
B. Dessertenne and A. Jacques Sep. 1974 38 p refs In FRENCH
(Contract DGRST-73-7-1462)
(LCR-086/026) Avail: NTIS HC $3.75

The photodetector is sensitive in the visible and near infrared at YAG laser frequencies and has a response time of 100 pS. A possible geometry is described using a PIN photodiode matched to 50 ohms of 10 microns thickness. On Si substrate the relevant techniques are detailed. Two systems are used to couple the photodiode using either direct coupling or distributed coupling, the relative merits of which are discussed. ESRO

N75-28313+ Radiotechniques S. A., Caen (France). Div. Industrielle et Technique.
CHARACTERISTICS OF INJECTION LOGIC AND COMPATIBILITY WITH OTHER TECHNOLOGIES Final Report [DEFINITION DES CARACTERISTIQUES DE LA LOGIQUE A INJECTION ET DE SA COMPATIBILITE AVEC LES AUTRES TECHNOLOGIES]
P. Guetin Oct. 1974 64 p In FRENCH
(Contract DGRST-73-7-1329)
Avail: NTIS HC $4.25

A technology assessment was carried out on large scale integration by injection logic. It is shown that the main advantages lie with high integration density, very low power consumption and ease of topology whereas the signal to noise ratios, mean speed, and outputs are disadvantages. Static measurements were performed together with propagation time and temperature effect measurements. A variety of logic circuits is proposed. The annexes deal with specific problems such as hogging in DCTL, definition and measurement of transistor gain in injection logic, experimental gains, gate delay, and series of injectors and interfaces. ESRO

N75-28314+ SILEC-Semiconducteurs S.A., Villejuif (France).
EXTENSION TOWARDS HIGH TEMPERATURES OF THYRISTOR OPERATION USING NEW INTEGRATED ANTIPARALLEL DIODE STRUCTURES Final Report [ETUDE DE L'EXTENSION VERS LES FORTES TEMPERATURES DU DOMAINE DE FONCTIONNEMENT DES THYRISTORS PAR REALISATION DE STRUCTURES ORIGINALES A DIODE ANTIPARALLELE INTEGREE]
R. Pezzani Feb. 1974 44 p refs In FRENCH
(Contract DGRST-72-7-0530)
Avail: NTIS HC $3.75

New structures to allow thyristors to operate at temperatures higher than 125 C are studied. The introduction of distributed anode short circuits enabled blocking of 1000 V at 200 C. The problems associated with commutation are detailed together with diffusion techniques. ESRO

N75-28315*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
ON OPTIMAL SOFT-DECISION DEMODULATION
Lin-nan Lee 1 Jul. 1975 24 p refs
(Grant NsG-5025)
(NASA-CR-143203; EE-753) Avail: NTIS HC $3.25 CSCL 09C

Wozencraft and Kennedy have suggested that the appropriate demodulator criterion of goodness is the cut-off rate of the discrete memoryless channel created by the modulation system; the criterion of goodness adopted in this note is the symmetric cut-off rate which differs from the former criterion only in that the signals are assumed equally likely. Massey's necessary condition for optimal demodulation of binary signals is generalized to M-ary signals. It is shown that the optimal demodulator decision regions in likelihood space are bounded by hyperplanes. An iterative method is formulated for finding these optimal decision regions from an initial good quess. For additive white Gaussian noise, the corresponding optimal decision regions in signal space are bounded by hypersurfaces with hyperplane asymptotes; these asymptotes themselves bound the decision regions of a demodulator which, in several examples, is shown to be virtually optimal. In many cases, the necessary condition for demodulator optimality is also sufficient, but a counter example to its general sufficiency is given. Author

N75-28316*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ELECTRONIC ANALOG DIVIDER Patent Application
Arthur G. Birchenough, inventor (to NASA) Filed 24 Jul. 1974 10 p
(NASA-Case-LEW-11881-1; US-Patent-Appl-SN-598968) Avail: NTIS HC $3.25 CSCL 09C

An electronic analog dividing circuit is described which shows accuracy at relatively low denominator (divisor) values. The known exponential characteristic of a diode was used which is, that particularly at low forward voltages and currents, the current is an exponential function of the voltage applied across the diode, and the incremental impedance of the diode is inversely proportional to the current through the diode. The diode bias current was made proportional to the desired denominator, and the incremental signal current was applied across the diode as a numerator; the resultant incremental voltage across the diode is proportional to the desired quotient. NASA

N75-28317# Naval Postgraduate School, Monterey, Calif.
DESIGN OPTIMIZATION OF METAL-INSULATOR SEMICONDUCTOR DEVICES FOR INFRARED SOLID STATE IMAGING M.S. Thesis
Numa Augustine Boudreaux, III Dec. 1974 108 p refs
(AD-A005472) Avail: NTIS CSCL 17/5

The study provides a methodology for design optimization of metal-insulator-semiconductor devices used as charge storage infrared detectors. A new general formulation for the calculation of efficient charge storage capacity is derived and compared to existing formulas. Design parameter constraints are examined and several performance improvement techniques are discussed. A new device structure is proposed which integrates many desirable features into a single element. The results of this study indicate that the trend should be toward charge injection devices constructed of p-type group IV-VI thin film semiconductors with high dielectric constant insulators using back-illumination through anti-reflection layers. GRA

N75-28318# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTAL STUDY OF CORRELATOR FILTERS NOT UTILIZING A DELAY M.S. Thesis
Tito Manlio Rincon Dec. 1974 79 p refs
(AD-A005467) Avail: NTIS CSCL 09/5

This work is an application of the methods in obtaining the correlation functions. In particular, the method of correlation without a pure time-delay is presented together with the concept of orthogonal filters, which are Laguerre function type filters. Of these filters, the non-symmetric Laguerre type is analyzed and used to realize a practical correlator designed for low frequency signals. The correlator was computer-simulated by the DSL subroutine and the results of the autocorrelation of a 155 Hz sine wave were compared to the results obtained for the autocorrelation of a similar wave in the actual correlator. A detail

description of the design of the correlator and of the DSL program used are also presented. GRA

N75-28319# Naval Postgraduate School, Monterey, Calif.
CHARGE-COUPLED DEVICES FOR ANALOG SIGNAL PROCESSING: RECURSIVE FILTER STUDY M.S. Thesis
Veerachai Iamsa-ad Dec. 1974 90 p refs
(AD-A005469) Avail: NTIS CSCL 09/1

Theoretical study of the first-order and the second-order discrete analog recursive filter, DAR, was carried out. Since the instrumentation was not adequate for the second-order CCD DAR filter, two MOS IC delays (SAD-100) were used for the second-order DAR filter experiments. The first-order low-pass and high-pass DAR filter experiments using the CCD and the SAD-100, and the second-order low-pass, high-pass, and band-pass DAR filter experiments using the SAD-100 only were conducted. Agreement between the experimental result and the theory is satisfactory. The result of this thesis indicates that both the CCD and the SAD-100 DAR filters may be useful for applications in which comb-filters and range gated filters are used. GRA

N75-28320# Army Foreign Science and Technology Center, Charlottesville, Va.
RESEARCH ON AN ASYNCHRONOUS ELECTRIC DRIVE WITH A SYMMETRICAL THYRISTOR IN ONE PHASE OF THE STATOR
N. Ya. Kravtsov 20 May 1974 8 p refs Transl. into ENGLISH from Sb. Nauch. Tr. Chelyabinsk. Politekh. Inst. (USSR), no. 94, 1971 p 139-143
(AD-A005519; FSTC-HT-23-0384-74) Avail: NTIS CSCL 09/3

Research on an asynchronous electric drive was done with a symmetrical thyristor in one phase of the stator. With symmetrical resistances in the rotor circuit, the velocity adjustment range increased to 20, but was less with asymmetrical resistances. A direct-current tacho-generator should be used as a velocity sensor. GRA

N75-28321# National Bureau of Standards, Washington, D.C. Electronic Technology Div.
NBS INTERAGENCY TRANSDUCER PROJECT Progress Report, 1 Jul. - 30 Sep. 1974
Paul S. Lederer and John S. Hilten 20 Feb. 1975 16 p Sponsored in part by Range Commanders Council, Albuquerque, N. Mex.
(COM-75-10367/1; NBSIR-75-654) Avail: NTIS HC $3.25 CSCL 14B

A method is being developed to apply short duration thermal transients to pressure transducers and to observe the effects of these transients on transducer performance. The method consists of monitoring pressure transducer output as the transducer is exposed to radiation resulting from the ignition of a photographic flashbulb or from the discharge of an electronic flash. Thermal energy pulses as high as 0.4 J lasting 4 ms have been generated using an electronic flash; pulses as high as 1 J lasting 18 ms have been generated using No. 22 flashbulbs. GRA

N75-28322# Naval Civil Engineering Lab., Port Hueneme, Calif.
INSULATION BOARDS IN SWITCHGEAR AT NAVY SHORE FACILITIES Final Report, Nov. 1973 - Jul. 1974
David E. Weems Dec. 1974 9 p
(AD-A004939; CEL-TN-1366) Avail: NTIS CSCL 09/1

The Civil Engineering Laboratory was tasked to determine the cause of failures experienced with the insulation boards used in recently procured electrical power switchgears at Navy Shore Facilities. Phenolic and polyester glass materials used as bus supports (the area of failure) were tested under high voltage to ascertain their time-to-track resistance properties. Also samples of the same materials were coated with silicone grease and tested. It was found that polyester glass insulation material meeting the requirements of MIL-M-14G Type MAT-30 will provide reliable service when used as bus supports in 15-kv switchgear. The application of silicone grease caused little improvement in the track-resistance properties, and under certain environments could cause an adverse condition. Porcelain insulating material will not track and, under adverse environments, is the best material for bus supports. GRA

N75-28323# Varian Associates, Palo Alto, Calif.
EFFICIENCY ENHANCEMENT IN MEGAWATT LEVEL BROADBAND MICROWAVE AMPLIFIERS Final Report, 17 Nov. 1972 - 28 Jun. 1974
Robert J. Butwell Feb. 1975 41 p refs
(Contract F30602-73-C-0073)
(AD-A005683; RADC-TR-74-272) Avail: NTIS CSCL 09/5

The report covers effort expended on a theoretical and experimental investigation of methods of improving the conversion efficiency of relatively broadband linear-beam amplifiers operating at approximately 1 Mw of peak power. A design was achieved using a short-stack intense-interaction cloverleaf structure; a forward-fundamental, coupled-cavity circuit. Computer-aided calculations predicted 40% minimum efficiency over a 9% bandwidth with a midband efficiency greater than 60%. GRA

N75-28324# Naval Postgraduate School, Monterey, Calif.
STUDIES OF SEA-STATE EFFECTS ON ANTENNAS IN SHIPBOARD COMMUNICATIONS SYSTEMS Final Report, Sep. 1969 - Dec. 1971
Richard W. Adler and George A. Rahe Aug. 1974 63 p refs
(AD-A004987; NPS-52AB74081) Avail: NTIS CSCL 09/5

The effect of sea surface conditions on the performance on antennas in VLF, HF and VHF shipboard communications is addressed. In the VLF range, towed buoyant cables are examined. The equations of force are derived and presented and the towed cable configuration is simulated on a hybrid computer. A method of calculating the received voltage is developed. The complexity of simulating a cable antenna in a real-world sea surface environment is addressed. HF shipboard antennas used in ionospheric communications systems are simulated on the hybrid computer and the effect of sea state is determined by calculating the time varying gain pattern of the antennas. Recommendations for antenna types which are less sensitive to sea state are made. A similar simulation conducted for a VHF radiator on a ship in typical sea conditions is compared with measured received signals. GRA

N75-28325# McDonnell-Douglas Electronics Co., St. Charles, Mo.
SOLID STATE HIGH POWER AMPLIFIER FOR UHF Final Technical Report, 27 Sep. 1973 - 31 Oct. 1974
Quentin F. Veit, Franklin D. Hockett, and Roger L. Fredrick Nov. 1974 207 p refs
(Contract DAAB07-74-C-0049; DA Proj. 1X7-64701-D-87)
(AD-A005087; ECOM-0049-F) Avail: NTIS CSCL 09/5

The report describes the design approach, detailed design, and fabrication of a UHF solid-state broadband power amplifier/duplexer. The report contains detailed descriptions of and test data on the components and subassemblies of the amplifier/duplexer plus test data obtained on the final unit. Distinguishing characteristics of the amplifier/duplexer are a frequency range of 695 to 1000 MHz, power gain of greater than 10 db, output power of 250 watt CW, and receiver duplexing capability. GRA

N75-28326# Radio Corp. of America, Burlington, Mass. Government Communications and Automated Systems Div.
PRODUCTION ENGINEERING MEASURES AUTOMATIC ASSEMBLY OF HYBRID INTEGRATED CIRCUITS Quarterly Progress Report, 1 May - 31 Jul. 1974
R. P. Bintliff 13 Dec. 1974 52 p refs
(Contract DAAB05-73-C-2039)
(AD-A005075; QPR-2) Avail: NTIS CSCL 09/5

Effort was initiated to develop automatic techniques and equipment capable of mass production of thick film hybrid integrated circuits. The amplifier trigger circuit, Army Part Number 11717226, used in the XM734 multi-option fuse has been selected as the assembly which will serve as the test vehicle. GRA

N75-28327# MB Associates, San Ramon, Calif.
ANTENNA MODELING PROGRAM: COMPOSITE USER'S MANUAL
Oct. 1974 136 p Sponsored by Army and AF
(Contract N00014-71-C-0187)
(AD-A005673; MB-R-74/46) Avail: NTIS CSCL 09/5

The manual contains instructions for use of the antenna modeling program (AMP) for analysis of general antennas in

their environment. Instructions for program input and interpretation of the output are presented in a concise form to permit use of the program with a minimum of theoretical understanding. Sample runs are also included to show typical output and to provide data which can be used as a standard to check the operation of a newly duplicated or modified deck. GRA

N75-28328# Army Foreign Science and Technology Center, Charlottesville, Va.
MAGNETIC FIELD IN AN ASYNCHRONOUS MACHINE WITH A CONDUCTIVE COATING ON THE ROTOR
L. D. Maergoyz and B. I. Polishchuk 31 May 1974 20 p refs Transl. into ENGLISH Kibernetika i Vychislitelnaya Tekhn. (USSR), no. 11, 1971 p 113-125
(AD-A004967; FSTC-HT-23-1598-73) Avail: NTIS CSCL 09/3

A method of calculating asynchronous electric machines with a massive solid rotor is detailed. By solving the nonlinear boundary value problem of the tangential stress of the magnetic field, expressions are derived for the displacement process of the magnetic system. GRA

N75-28329# Sprague Electric Co., North Adams, Mass.
PRODUCTION ENGINEERING MEASURE FOR HYBRID INTEGRATED CIRCUITS FOR FUZE APPLICATIONS. PART 1: INTEGRATED ARMING AND FIRING CIRCUIT. PART 2: PRECISION OSCILLATOR INTEGRATED CIRCUIT Quarterly Report, 22 Jun. - 26 Sep. 1974
T. Sciacca and H. G. Brandt Oct. 1974 30 p refs
(Contract DAAB05-71-C-2642)
(AD-A005234; QR-13) Avail: NTIS CSCL 09/5

The objective of the production engineering measure is to establish a production capability for hybrid-integrated circuits for fuze applications. The Integrated Arming and Firing Circuit involves the fabrication of a thick film circuit substrate, and attachment of transistors and capacitor components, and packaging. The program includes actual fabrication of test samples, a production run and performance of electrical, mechanical, and environmental tests as required. GRA

N75-28330# Radio Corp. of America, Harrison, N.J. Microwave Devices Operations Dept.
A PRODUCTION ENGINEERING MEASURE FOR TWO L-BAND SOLID STATE MICROWAVE FREQUENCY SOURCES Quarterly Report, 1 Aug. - 31 Oct. 1974
Daniel D. Mawhinney, Frank E. Vaccaro, and Brian Dornan 27 Nov. 1974 57 p refs
(Contract DAAB05-72-C-5830)
(AD-A005235; ECR-428-11; QR-10) Avail: NTIS CSCL 09/5

A production engineering measure (PEM) for two L-Band Solid State Microwave Frequency Sources was continued. These two devices are a radiosonde modulator/transmitter and an FM power source. All work has been completed on the radiosonde modulator/transmitter (unit A). The First Article Test Report has been issued and the pilot production run of 500 FM Power Source units (unit B) has been started. GRA

N75-28331# Boeing Aerospace Co., Seattle, Wash.
CROSS-COUPLING IN THE SAFEGUARD SYSTEM Final Report
Dec. 1974 106 p refs
(Contract DACA87-72-C-0002)
(AD-A005619; TM-81) Avail: NTIS CSCL 15/3

Cross-coupling of EMP-induced electrical transients in the SAFEGUARD system has been divided into three broad categories: small enclosures, conduit runs, and cable spreading room. For the first two, models were constructed based on comparisons with available test data. From these models, a variety of cross-coupling results were calculated which can be applied directly to SAFEGUARD EMP analyses. The model parameters were chosen to be reasonable but conservative. Enough different situations are reflected in the calculated results so that most of the cross-coupling situations in the SAFEGUARD system are covered. The degree of sophistication of the models is consistent with the analyses performed for SAFEGUARD equipment/flowpath evaluations. The degree of cross coupling in the cable spreading room is obtained from test data taken at the SAFEGUARD North Dakota site. GRA

N75-28332# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
STUDY OF FIELD ASSISTED PHOTOCATHODES WITH DOUBLE HETEROJUNCTION STRUCTURE Semiannual Technical Report
A. G. Milnes, D. L. Feucht, and P. K. Govil Feb. 1974 26 p (Contract DAAK02-72-C-0206; ARPA Order 2182)
(AD-A005019; SATR-4) Avail: NTIS CSCL 09/1

The work on the research grant is concerned with the general concept of double heterojunction field assisted photocathodes. In order to accomplish this study the following three areas of investigation have been defined: Design analysis to determine the required structure and the quantum yield for double heterojunction field assisted cathodes; Development of the materials and device fabrication techniques for the Ge/ZnSe/GaAs structure; and, Measurement of the electron transport properties in Ge/ZnSe/GaAs structures. GRA

N75-28333# Picatinny Arsenal, Dover, N.J.
NUCLEAR RADIATION TESTING OF DIODES, SILICON CONTROLLED RECTIFIERS, TRANSISTORS AND INTEGRATED CIRCUITS
E. T. Cassidy Dec. 1974 76 p refs
(AD-A005590; PA-TR-4692) Avail: NTIS CSCL 09/1

Extensive nuclear radiation tests were conducted on various types of diodes, transistors, silicon controlled rectifiers, DTL and CMOS integrated circuits for use in digital electronics. The nuclear radiation effects considered during this test program were endoatmospheric, i.e. neutron and gamma dose rates. The digital electronics employing the semiconductors tested are used in either ground systems or low-flying missiles, therefore, no exoatmospheric effects such as X-rays were evaluated. The report documents the components tested, test methods, radiation test facilities used and the test results for each component tested. GRA

N75-28334# Monsanto Research Corp., Dayton, Ohio.
PLANAR HIGH ENERGY PERMANENT MAGNETS Semiannual Report, 1 Apr. - 30 Sep. 1974
M. C. Willson and R. J. Janowiecki Jan. 1975 58 p refs
(Contract DAAB07-73-C-0112; DA Proj. 1T7-62705-A-348)
(AD-A005080; ECOM-73-0112-3) Avail: NTIS CSCL 09/1

Samarium-cobalt permanent magnets were fabricated by arc plasma spraying. The technique is being investigated as an economical method for fabricating cobalt-rare earth magnets for advanced traveling wave tubes and cross-field amplifiers. Plasma spraying permits deposition of material at high rates over large areas with optional direct bonding to the substrate, and offers the ability to fabricate magnets in a variety of shapes and sizes. Magnets were produced with high coercivity and good reproducibility in magnetic properties. Post-spray thermal treatments were used to enhance the magnetic properties of sprayed deposits. Samarium-cobalt magnets, sprayed from samarium-rich powder and subjected to post-spray heat treatment, displayed energy products in excess of 9 million gaussoersteds and coercive forces of approximately 6000 oersteds. Bar magnet arrays were constructed by depositing magnets on ceramic substrates and the axial field profiles of such arrays were determined. Ring magnet fabrication was initiated. GRA

N75-28335# Beta Industries, Inc., Dayton, Ohio.
RESEARCH AND DEVELOPMENT OF NON-ACTIVE SURFACE NEA EMITTER Semiannual Report, 1 Jun. 1973 - 31 May 1974
John L. Mize Dec. 1974 85 p refs
(Contract DAAB07-73-C-0225)
(AD-A005628; BII-230-2; ECOM-0225-2) Avail: NTIS CSCL 09/1

Studies and research were conducted on the Variable Affinity Barrier (VAB), tin oxide cold cathodes. These studies were directed toward elucidating the underlying mechanisms responsible for the emission of electrons from these structures. GRA

N75-28336# Army Foreign Science and Technology Center, Charlottesville, Va.
AN ANALYSIS OF THE DEPENDENCE OF PHOTOVOLT TYPE HIGH VOLTAGE MATRIX PHOTOELECTRIC GENERATORS ON RADIATION INTENSITY AND TEMPERATURE

A. K. Zaitseva and A. A. Polisan 26 Mar. 1974 8 p refs Transl. into ENGLISH from Geliotekhnika (USSR), no. 3, 1972 p 28-31
(AD-A005203; FSTC-HT-23-1586-73) Avail: NTIS CSCL 09/1

The paper examines and interprets the dependence of the instrument's electrical characteristics on radiation intensity, which is somewhat different from similar dependences in conventional photoelectric generators. The temperature dependences of electrical characteristics in conventional photoelectric generators and those of the Photovolt type are found to be identical. GRA

N75-28337# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF THE NOISE PROPERTIES OF PLANAR TRANSISTORS
N. V. Karyakina, E. D. Polikarpov, and E. A. Khenkin 22 Jan. 1974 9 p refs Transl. into ENGLISH from Poluprov. Prib. Ikh Primen., Sb. Statei (Moscow), No. 24, 1970
(AD-A004925; FSTC-HT-23-1571-73) Avail: NTIS CSCL 09/1

According to measurements carried out planar transistors have relatively low noise figures. As amplifiers planar transistors have their lowest noise figures of 1-2 db at an emitter current of about 0.4 -0.6 ma and a signal source resistance of 300-400 ohms. As frequency converters they have minimum noise figures of about 4-6 db. GRA

N75-28338# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Electrical Engineering.
STUDY OF FIELD ASSISTED PHOTOCATHODES WITH DOUBLE HETEROJUNCTION STRUCTURE Final Report
A. G. Milnes, D. L. Feucht, and P. K. Govil Jun. 1974 110 p refs
(Contract DAAK02-72-C-0206; ARPA Order 2182)
(AD-A005020) Avail: NTIS CSCL 09/1

The Ge/ZnSe/GaAs structure studied is potentially capable of giving emission efficiency for 1-1.7 micrometer infrared radiation. Growth of ZnSe on Ge by the HCl close space transport process was investigated. These junctions showed switching characteristics associated with traps. The trapping actions prevented electrons photoinduced in the Ge from crossing into the ZnSe with high transfer efficiency. Fabrication, surface properties, quantum efficiency and Auger spectroscopy of the ZnSe/Ge diodes are studied. GRA

N75-28339# RCA Labs., Princeton, N.J.
MICROWAVE FREQUENCY MEMORY USING GaAs TRANSFERRED-ELECTRON DEVICES Interim Report, 15 May - 14 Nov. 1974
Walter R. Curtice 20 Dec. 1974 55 p refs
(Contract N00014-74-C-0371; NR Proj. 251-015; RF54545001)
(AD-A004996; PRRL-74-CR-73) Avail: NTIS CSCL 09/5

An investigation was made of the behavior of a transferred-electron device (TED) in a multimode resonant microwave cavity, to design such cavity and TED to optimize the number of allowed memory states in a given overall bandwidth, and to initiate a theoretical and experimental study leading toward development of a compact multimode cavity structure suitable for ECM frequency memory applications above 8 GHz. The study includes but is not limited to microstrip resonators. TE memorizers were designed and constructed using coaxial, waveguide, and alumina microstrip circuits. Operation between 10.34 and 12.46 GHz with 17 states spaced about 132 MHz apart was demonstrated with a 2-in. x 2-in. x 0.025-in. alumina circuit. A 5-foot waveguide circuit has operated between 9.75 and 10.82 GHz with 16 states spaced about 71 MHz apart, as was a 7-foot coaxial circuit between 11.0 and 11.77 GHz with 18 states spaced about 45 MHz apart. Switching between states has been achieved with pulsed rf input signals as short as 0.1 microsec. GRA

N75-28340# Stanford Univ., Calif. Integrated Circuits Lab.
ADVANCED TECHNOLOGY FOR MICROPOWER INTEGRATED CIRCUITS Annual Report, 30 Jun. 1972 - 29 Jun. 1973
J. D. Meindl and T. J. Rodgers Jan. 1975 36 p refs
(Contract DAAB07-72-C-0229; DA Proj. 1S7-62705-AH-94)
(AD-A005629; ECOM-72-0229-1) Avail: NTIS CSCL 09/5

A new V-groove process for the fabrication of bipolar integrated circuits was developed. The process requires carefully controlled deposition of epitaxial layers and anisotropic etching of silicon. The resulting structure eliminates the need for the conventional buried layer, isolation diffusion and masking for base diffusion. A four-mask process is used to make NPN transistors, resistors and Schottky diodes. A five-mask process can provide improved lateral PNP transistors. The second area of the activity was the development of vapor-phase arsenic doped polycrystalline silicon resistors of high value. These resistors result in reproducibly high resistance, low parasitic capacitance and elimination of the need for isolation. GRA

N75-28341# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BEAM SEMICONDUCTOR RF AMPLIFIER WITH PLANAR DIODES Final Report, 8 Jan. 1973 - 31 May 1974
James A. Long May 1974 24 p
(Contract DAAB07-73-C-0079)
(AD-A005276; ECOM-0079-73-F) Avail: NTIS CSCL 09/1

The objective of the program was Research and Development on Electron Bombarded Semiconductor RF amplifiers with planar diodes for the purpose of establishing uniformity of the EBS device, determining the thermal impedance of the target diodes, constructing devices for life test and examining them after the completion of the life test. The EBS amplifier consists of an electron gun, a meander-line deflection structure and a target all mounted within a vacuum wall. GRA

N75-28342# Bendix Corp., Baltimore, Md. Communications Div.
TACTICAL MINIATURE CRYSTAL OSCILLATOR Semiannual Report, 1 Jun. 1973 - 31 Jan. 1974
H. M. Greenhouse and R. L. McGill Jan. 1975 57 p refs
(Contract DAAB07-73-C-0199; DA Proj. 1S7-62705-AN-94F)
(AD-A005287; ECOM-0199-1-73) Avail: NTIS CSCL 09/1

The report describes the further development of a fast warmup Tactical Miniature Crystal Oscillator (TMXO). The intended use for this TMXO is as a reference frequency source in advanced tactical communications systems and in time ordered navigational systems. The quartz resonator is enclosed in a special enclosure, maintained at a constant temperature equal to the upper turn point of the resonator. The top of the crystal enclosure is the bottom of the microcircuit enclosure. This enclosure contains the oscillator/amplifier circuitry, heater, temperature controller and fast warmup compensation network. Both enclosures are supported by a thermal insulator, and all enclosed in an evacuated outer case. Changes in the electrical, mechanical and thermal design are described, pertaining to the solution of the remaining problems. Electronic methods for achieving the fast warmup compensation are discussed. GRA

N75-28343# Illinois Univ., Urbana. Electromagnetics Lab.
STABILITY AND CONVERGENCE OF THE METHOD OF MOMENTS APPLIED TO ELECTROMAGNETIC PROBLEMS
Charles Klein and Raj Mittra Jan. 1975 223 p refs
(Contract DAHC04-74-G-0113)
(AD-A005214; UIEL-75-1; UILU-ENG-75-2538; ARO-12049.5-EL) Avail: NTIS CSCL 20/14

The method of moments is a simple technique for converting integral equations occurring in electromagnetics problems into matrix equations which can be easily solved on digital computers. The discussion and theory of stability and convergence are applied to six areas of applications - waveguide discontinuities, wavefront reconstruction, electrostatics, remote sensing, scattering by rectangular conducting cylinders, and thin-wire antennas and scatterers. GRA

N75-28344# Boeing Aerospace Co., Seattle, Wash.
SURGE SUPPRESSOR ISOLATION DEVICES
Dec. 1974 44 p refs
(Contract DACA87-72-C-0002)
(AD-A005622; TM-86) Avail: NTIS CSCL 15/3

A theoretical and empirical analysis was conducted to determine the effectiveness of surge capacitors and surge arrestors in suppressing EMP-induced transients. The attenuation was

found to be only 3 d for a 10 nanosecond risetime pulse and 9 d for a 100 nanosecond risetime pulse. For slower pulses the surge arrestors and capacitors operated normally. GRA

N75-28345# Boeing Aerospace Co., Seattle, Wash.
COMPONENT DAMAGE/MALFUNCTION LEVELS Final Report
Dec. 1974 97 p refs
(Contract DACA87-72-C-0002)
(AD-A005617; TM-15) Avail: NTIS CSCL 15/3

Damage/malfunction thresholds for mission-critical EMP-sensitive equipment of the SAFEGUARD Tactical Support Equipment have been determined by analysis and by laboratory tests. For inductive components and equipments insulation breakdown is the damage mechanism. For equipment containing solid-state semiconductors burnout of the sensitive piecepart governs. For low-voltage capacitors overvoltage at the capacitor is the damage mechanism. Methods used to calculate the damage/malfunction thresholds are given and a summary of the laboratory test results. GRA

N75-28346# Boeing Aerospace Co., Seattle, Wash.
RFI FILTER EVALUATION Final Report
Dec. 1974 48 p refs
(Contract DACA87-72-C-0002)
(AD-A005618; TM-80) Avail: NTIS CSCL 15/3

EMP isolation provided by RFI filters in the SAFEGUARD North Dakota site is evaluated. A mathematical model of typical filters is developed. Comparisons with manufacturing acceptance specifications and with test measurements onsite are used to confirm the model. Isolation of EMP transients in the SAFEGUARD installation is shown to be at least 50 dB. GRA

N75-28347# Boeing Aerospace Co., Seattle, Wash.
FLEX CONDUIT ACCEPTABILITY EVALUATION Final Report
4 Dec. 1974 15 p refs
(Contract DACA87-72-C-0002)
(AD-A005625; TM-100) Avail: NTIS CSCL 15/3

Worst-case EMP coupling to core wires contained in Sealtight-type flexible conduit is evaluated. The results are derived from illumination tests at the SAFEGUARD North Dakota site, as well as from laboratory tests on sample sections of flexible conduit. GRA

N75-28348# Lincoln Lab., Mass. Inst. of Tech., Lexington.
PHASE-DELAY-TYPE ARTIFICIAL DIELECTRICS
Leonard L. Tsai 17 Jan. 1975 50 p refs
(Contract F19628-73-C-0002)
(AD-A005687; TN-1975-4; ESD-TR-75-105) Avail: NTIS CSCL 09/1

The report is based on a survey of the literature on phase-delay artificial dielectrics to examine their suitability for multiple-beam antennas for satellite communications. The conclusions are that arrays of conducting discs appear to be suitable for such application because they can be used with circularly polarized fields and can be built with a desirable index of refraction, in the neighborhood of 1.5. A review of theoretical and measured results is presented, with formulas and curves permitting selection of parameters and permitting determination of the effect of tolerances and of frequency variation. No information was found on the inherent loss of such a medium. In the appendix, digests of 27 selected papers on the subject are presented. GRA

N75-28349# Naval Civil Engineering Lab., Port Hueneme, Calif.
SOLID-STATE TRIP CIRCUIT BREAKERS IN NAVY ELECTRICAL POWER SYSTEMS Final Report, Jul. 1973 - Jun. 1974
David E. Weems Feb. 1975 16 p refs
(YF53534006)
(AD-A004933; CEL-TN-1375) Avail: NTIS CSCL 09/1

An investigation was made of the suitability of solid-state trip circuit breakers as substitutes for electromechanical circuit breakers in Navy electrical power systems. Two types of tests were conducted: ambient temperature was varied to determine its effect on the time-versus-current curve, and a salt-fog environment was simulated to determine its effect on the physical behavior of the circuit breakers. The effect of temperature on the time-versus-current characteristics was negligible; the characteristics were still within the manufacturers' specified tolerance for this temperature range. The results of these temperature tests indicate that the solid-state circuit breakers are superior to the molded-case circuit breakers for installation where high ambient temperatures prevail or where coordination of protective devices is important. The salt-fog tests showed that the electronic trip units are more vulnerable to failure in a heavy salt-laden environment than the trip units of electromechanical circuit breakers. GRA

N75-28350# Adelaide Univ. (Australia).
HARMONIC EVALUATION OF TRANSFERRED ELECTRON DEVICES Final Report
D. W. Griffin Dec. 1974 164 p refs
(Contract F30602-70-C-0217)
(AD-A005684; RADC-TR-74-314) Avail: NTIS CSCL 09/1

The research on the harmonic evaluation of TED's falls into three main areas; design aspects of mounting structures, computer simulation of the interaction between TED and mounting structure and the effect of heat generation on performance. A novel two-port oscillator mount for simultaneous but independent tuning, loading and monitoring of the fundamental oscillation and its second harmonic was designed. The assembly provides a means for experimentally studying efficiency enhancement by harmonic tuning and conditions for optimizing the ratio of wanted to unwanted components in the oscillator output. Computer simulation of the interaction between TED and mounting structure was developed and used for operation involving fundamental and harmonic components of both voltage and current. Device-circuit interaction that gives rise to harmonic and other unwanted components of output are further compounded when the bias on the device is pulsed. The effect of the resulting time-varying temperature profile in the active layer of the device was investigated both experimentally and theoretically. GRA

N75-28351# Air Force Systems Command, Andrews AFB, Md. Foreign Technology Div.
SOME QUESTIONS IN MEASURING HODOGRAPHS OF THE INTERFERENCES BETWEEN THE CIRCUITS OF OPERATING CABLE MAIN LINES
S. M. Vernik, B. K. Gushchin, and B. S. Rapoport 20 Nov. 1974 15 p Transl. into ENGLISH from Tr. Uchebn. Inst. Svyazi (Leningrad), no. 53, 1971 p 135-140
(AD-A005061; FTD-MT-24-2566-74) Avail: NTIS CSCL 09/1

The article examines three fundamental problems connected with the measurement of hodographs of the interferences between the circuits of the operating cable main lines without a break in connection: the estimation of error in the discreteness of the interference hodographs, the nature and distribution of noises in the interchannel frequency gaps in the sealing equipment, and the methods for suppressing these noises. GRA

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics*.

N75-28352 British Library Lending Div., Boston Spa (England).
USE OF THE SUPERIMPOSITION OF A UNIFORM FLOW AND OTHER SIMPLEST FORMS OF FLOW FOR PLOTTING BASIC SOLUTIONS TO THE PROBLEMS OF THE PRESSURE TREATMENT OF METAL
B. V. Kucheryaev, P. I. Polukhin, and I. N. Potapov [1974] 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 3, 1974 p 39-43
(BLL-M-21959-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A principle employing superimposition of potential speed fields is suggested for plotting basic solutions to metal pressure treatment problems. A complex potential describing the flow in a given zone is presented in the form of a linear combination

of the uniform flow and other simplest forms of flow such as source and vortex-dipole flows. The kinematic parameters of the superimposed fields appear as variable parameters providing a minimum of potentials. The method can be used for plotting the three-dimensional, kinematically possible, speed fields.
Author

N75-28353 British Library Lending Div., Boston Spa (England).
RAPIDLY ROTATING IMPELLERS UNDER LAMINAR-FLOW CONDITIONS. PART 2: SIMULATION OF MECHANICAL AGITATION BY A ROTATING LOW CYLINDER
K. Wichterle, J. Proskova, and J. Ulbrecht 9 Jul. 1974 10 p refs Transl. into ENGLISH from Chem. Ing. Tech. (Weinheim/Bergstr.), v. 43, no. 15, 1971 p 867-70 In ENGLISH and GERMAN
(BLL-NEL-TT-2575-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Various properties of the velocity field in the vicinity of rapidly rotating impellers were investigated on the basis of the dynamic effects produced by a rotating low cylinder on a fluid. A hypothesis on the additivity of the effects of the individual surfaces of a rotating body is presented. On the basis of these assumptions, the relationship between the turning moment of impellers and their geometrical arrangement and the flow-behavior index may be determined from a knowledge of the turning moments established during the rotation of simple bodies. Good agreement between the experimental results and the theoretical conclusions was obtained.
Author

N75-28354 British Library Lending Div., Boston Spa (England).
LIMITS OF ENERGY TRANSPORT IN HEAT PIPES
K. Moritz and R. Pruschek [1974] 24 p refs Transl. into ENGLISH from Chem. Ing. Tech. (West Germany), v. 41, 1969 p 30-37
(BLL-M-23414-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

Fluid flow, evaporation, and overheating of a liquid metal within heat pipes having porous walls was studied experimentally. Flow resistance and pressure changes were calculated. Heat flow densities were determined. Heat pipes, differing in the form of wick linings inside them (annular, and wire gauze) were compared and evaluated using liquid Na as the transport agent. Results indicate that annular wicks are unsuitable for transporting large heating surface loads, as opposed to wicks made up of several layers of wire gauze. Results also indicate that the film of the transport agent should be as thin as possible to insure surface evaporation and to avoid overheating. Cross-sections of pipes are shown.
J.R.T.

N75-28355 British Library Lending Div., Boston Spa (England).
THE LIMITS OF SUCCESS IN FORECASTING THE TIME VARIATION OF TEMPERATURE USING THE ANALOGUE METHOD
R. G. Rejtenbah [1974] 18 p refs Transl. into ENGLISH from Gidromet. Nauka, Issled. Cent. SSSR (Leningrad), v. 106, 1973 p 61-68
(BLL-M-23407-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

An analog method of weather forecasting is presented. Weather forecasts are made by utilizing data from coincident calendar periods of previous years. The method was applied to forecasting temperatures, cloud cover, and precipitation in Moscow and Kiev. Greater accuracy was shown in forecasting temperature during the summer than in the winter; greater accuracy in forecasting total precipitation during the winter than in the summer. Further study revealed that the use of analogs in periods not coincident on the calendar with those to be forecast yields a marked increase in accuracy.
D.M.L.

N75-28356 British Library Lending Div., Boston Spa (England).
ADIABATIC DISTURBANCES IN A ROTATING FLUID
A. S. Monin [1974] 13 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 210, no. 4, 1974 p 784-787
(BLL-M-23633-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A mathematical model of the hydrostatics of ocean water is presented.
J.R.T.

N75-28357 British Library Lending Div., Boston Spa (England).
THE FORENOZZLE WITH DIFFUSER IN PNEUMATIC LINEAR MEASURING TECHNOLOGY ARRANGEMENTS
W. Lotze 15 May 1974 12 p refs Transl. into ENGLISH from Feingeraetetechnik (Berlin), v. 22, no. 6, 1973 p 257-260 In ENGLISH and GERMAN
(BLL-NEL-TT-2556-(6075.461))Avail: British Library Lending Div., Boston Spa, Engl: 2 BLL photocopy coupons

Characteristic curves were developed for a pneumatic precision pointer with a modified forenozzle. Characteristic and possible arrangements of diffuser forenozzles for pneumatic linear measuring technology are shown with some experimentally verified examples.
Author

N75-28358 California Univ., Davis.
A CHARACTERIZATION OF UNSTEADY GAS DISCHARGE FROM A VESSEL Ph.D. Thesis
Sheridan Clark Johnston 1974 277 p
Avail: Univ. Microfilms Order No. 75-15439

The discharge of compressed gas from a vessel through an orifice to the atmosphere is investigated and the effects of heat transfer on the discharge are evaluated. Included in the study are experiments to investigate (1) an uncoupling between the heat transfer and gas dynamic contributions to the instantaneous mass flow rate from the vessel, (2) the dynamics of the vessel wall diffusion layer (which is formed by heat addition from the vessel wall to the rapidly expanding gas), including buoyancy driven instabilities and their effect on the discharge process, and (3) bulk temperature evaluation from point temperature measurements in the highly nonuniform thermal environment of the discharging gas reservoir. In addition, a semi-empirical theory for determining gas pressure and bulk temperature during discharge has been developed.
Dissert. Abstr.

N75-28359 Michigan State Univ., East Lansing.
INVISCID COMPRESSIBLE FLUID FLOW IN A CURVED MEMBRANE SHELL Ph.D. Thesis
Robert Jennings Waldron 1974 260 p
Avail: Univ. Microfilms Order No. 75-14857

A thin membrane, cylindrical shell of radius a is coiled into a torus of radius R. The shell is filled with a compressible, inviscid fluid which is flowing axisymmetrically as it enters the coil. The Navier Stokes equations are used to describe the fluid motion while the dynamic form of Sanders' shell equations describes the motion of the membrane shell. All variables are expanded in a series about delta small, delta = aR-1. Wave solutions are sought. The object of the analysis is to find the first nonzero correction to the frequency equation where the zero order terms are interpreted as representing the straight tube flow. The correction, s sub 2 was determined in closed form for the special cases of wave motion of a fluid in a rigid tube, the free flowing jet of fluid, the vibrations of an empty tube, and the interaction problem of a fluid flowing in an elastic shell. The corrected phase velocity is compared to the straight tube phase velocity for all four cases.
Dissert. Abstr.

N75-28360 Notre Dame Univ., Ind.
SQUEEZING FLOW AND ASSOCIATED FLOWS Ph.D. Thesis
David Michael DaCunha 1975 175 p
Avail: Univ. Microfilms Order No. 75-13923

The method of successive approximations was used to obtain approximate solutions of the problem of plane, incompressible, laminar, unsteady squeezing flow. Two cases were solved; plane squeezing flow with constant Reynolds number and plane squeezing flow with constant wall velocity. The method of successive approximations was also used to solve the cases of developing Hiemenz flow and of developing plane stagnation flow between fixed parallel walls with constant uniform injection at both walls. A technical solution was found for the case of steady plane stagnation flow and was integrated numerically. Numerical solutions were obtained for all the above flows, using the alternating-direction-implicit method to solve the vorticity-transport equation, and the method of successive over-relaxation to solve the stream-function equations. The numerical solutions were compared with the corresponding analytical solutions.
Dissert. Abstr.

N75-28361 City Univ. of New York.
VISCID-INVISCID FLOW INTERACTIONS Ph.D. Thesis
King-Mon Tu 1975 101 p
Avail: Univ. Microfilms Order No. 75-13642

An approximate nonasymptotic theory is presented for self-sustaining supersonic laminar boundary layer interaction which is based on the three layer conceptual model which explains the upstream propagation of disturbances in linear shock wave boundary layer interaction where separation does not occur and in nonlinear interactions with separation, using an asymptotic analysis valid for infinite Reynolds number. This investigation extends the basic three layer model for laminar boundary layer free interaction phenomena to physically realizable flows in a Reynolds number range where the viscous sublayer cannot be viewed as thin in an asymptotic sense. Both major shortcomings of the lowest order asymptotic analysis, the neglect of the stream tube divergence in the inviscid interaction layer and compressibility effect in the viscous sublayer, are considered. Another feature is the separation pressure criterion used to determine the effective edge of the laminar viscous sublayer.
Dissert. Abstr.

N75-28362 California Univ., Davis.
A STUDY OF IMPINGING AXISYMMETRIC TURBULENT FLOWS: THE WALL JET, THE RADIAL JET, AND OPPOSING FREE JETS Ph.D. Thesis
Peter Ostrander Witze 1974 179 p
Avail: Univ. Microfilms Order No. 75-15469

The results of an experimental and analytic study of impinging axisymmetric turbulent flows are presented. Three impinging-flow configurations are considered: a single axisymmetric turbulent jet impinging normal to a plate, two directly-opposing axisymmetric turbulent jets of equal momentum flux impinging against each other, and a constrained radial jet as produced by the radial flow from an annular orifice formed by two parallel circular disks. The purpose of the investigation is to characterize the structure of these flows, with the goal of identifying and analytically modeling the regions of physically similar flow behavior. The analogy between an unopposed axisymmetric turbulent jet and a jet opposed by either a wall or another jet is established. Similarly, the analogy between a wall jet, a constrained radial jet, and an impinged radial jet as formed by the collision of opposing free jets is demonstrated.
Dissert. Abstr.

N75-28363 Adelphi Univ., Garden City, N.Y.
FLUID REACTION ON A BAFFLED PLANE PISTON OF ARBITRARY SHAPE, WITH SPECIAL APPLICATION TO THE ELLIPTIC PISTON Ph.D. Thesis
Oscar A. Lindemann 1975 175 p
Avail: Univ. Microfilms Order No. 75-15178

The dependence of the radiation impedance of a baffled piston on its shape is analyzed. It is argued that the inverse Laplace transform of the frequency dependent radiation impedance, i.e., the impulse response of the piston, is a function more directly related to the geometry of the piston than the impedance itself. It is shown how this function can be described in terms of a finite, characteristic pulse, whose shape depends on that of the piston, and that its evaluation consists of a relatively simple integration around the piston contour. Several examples show that the characteristic pulse can be evaluated exactly for certain piston shapes. Fundamental relationships between the geometrical features of the piston, the characteristic pulse and the radiation impedance are derived. The theory of the asymptotic properties of Fourier transforms is applied to the problem. The elliptic piston is utilized as an example of the described techniques.
Dissert. Abstr.

N75-28364 Idaho Univ., Moscow.
SCHLIEREN STUDIES OF FILM COOLING Ph.D. Thesis
Robert Young-Jiann Chang 1975 192 p
Avail: Univ. Microfilms Order No. 75-15944

An experimental study of film cooling is presented for three extreme cool air injection designs, namely, the stepdown tangential, the tangential and the angular injections. The comparisons of the film cooling effectiveness factor among the designs show the superiority of the stepdown tangential injection. In all three designs, schlieren pictures show that the degree of mixing between the cool and hot air is highly affected by the injection box geometry.
Dissert. Abstr.

N75-28365 Idaho Univ., Moscow.
THE FLUID MECHANIC BASIS FOR THE DESIGN CRITERIA OF GRAVITY LIQUID-LIQUID SETTLERS Ph.D. Thesis
David Charles Drown 1975 325 p
Avail: Univ. Microfilms Order No. 75-15945

The fluid mechanic phenomena governing the operation of a horizontal gravity liquid-liquid settler were experimentally investigated. The hexane-water fluid system was used throughout most of the investigation, with the kerosene-water fluid system being used to verify the generality of the results. Many variables were investigated and the settler system was operated over an extremely wide range of conditions. Velocity patterns were measured using a laser Doppler velocimeter and motion picture techniques. The most significant finding was the ability of the dispersion zone between the two fluids to absorb momentum from the surrounding bulk phases. The dispersion zone flows as a plug, but at a markedly different velocity than the surrounding bulk phases. In addition it was found that the rate of coalescence was determined not only by the fluid properties as in a static environment, but also by the hydrodynamic forces between the drops which in turn affect the rate of bubble film drainage and film rupture.
Dissert. Abstr.

N75-28366 Pennsylvania Univ., Philadelphia.
NATURAL CONVECTION IN A CLOSED CAVITY WITH LOCALIZED HEATING ON ONE VERTICAL WALL Ph.D. Thesis
Humbert Hsi-shan Chu 1974 208 p
Avail: Univ. Microfilms Order No. 75-14554

The effect of localized heating in confined systems was studied using the partial differential equations representing laminar natural convection in a rectangular cavity. The heat source was a horizontal strip with uniform temperature, located on one, otherwise-insulated, vertical wall. The opposing vertical wall was isothermal at a lower temperature. Two different thermal conditions were used for the top and bottom walls. The isothermal model has an isothermal top and bottom, while the adiabatic model has a thermally insulated top and bottom. The partial differential equations for the temperature, vorticity, and stream function were solved numerically using the alternating direction, implicit method. Results are presented in plots of the streamlines and isotherms and in terms of numerical values for the maximum stream function and the mean Nusselt number. These results provide a rational basis for locating a heater or cooler. The computed flow field and thermal behavior are rationalized on physical grounds.
Dissert. Abstr.

N75-28367 Illinois Univ., Urbana.
THE BEHAVIOR OF ELASTIC HEAT CONDUCTORS WITH SECOND-ORDER RESPONSE FUNCTIONS Ph.D. Thesis
Stephen Edward Martin 1975 51 p
Avail: Univ. Microfilms Order No. 75-14141

Second order forms for the material response functions of an elastic heat conductor are derived by approximating the response functions by polynomials in the appropriate invariants. Solutions based upon these forms of the response functions are exact for special materials and approximate for general materials. Several aspects of the behavior of incompressible elastic heat conductors are investigated. The second order dependence on temperature of isothermal elasticity solutions is found and the results agree quite well with experimental data taken on rubber. The second order solutions to the problems of biaxial stretching with transverse heat flow, and simultaneous extension and shear of a cylindrical annulus with radial heat flow are obtained. If a material which is thermally insulated is deformed, in general, its temperature will change. This phenomenon, known as Gough-Joule heating, is investigated for materials subjected to strain impulses.
Dissert. Abstr.

N75-28368 Colorado State Univ., Fort Collins.
A SPLINE-FIT APPROACH FOR THE ANALYSIS OF CLOSED STREAMLINE FLOWS Ph.D. Thesis
Anantha Padmanabha Kumblekere Rao 1974 84 p
Avail: Univ. Microfilms Order No. 75-14674

The governing equations for laminar, incompressible, two

dimensional boundary layer flow in a swirl chamber with part of its boundary moving at a prescribed speed are derived in the von Mises plane. The equations are solved by a new technique called the spline-fit approach. In order to assess the performance of the new method, two other solutions are given, a linearized series approximation and a nonlinear solution using the method of lines. The results indicate that the new technique gives accuracy with a relatively coarse approximation and requires small computational times compared to the method of lines. Possible applications of the method to a few practical problems are discussed and future developments of the technique are projected. Dissert. Abstr.

N75-28369 Ernst-Mach-Inst., Freiburg (West Germany).
BLAST WAVE PROPAGATION OF DETONATING EXPLOSIVE BARS IN A TUBE WITH RIGHT ANGLED JUNCTION [AUSBREITUNG VON LUFTSTOSSWELLEN DETONIERENDER SPRENGSTOFFSTANGEN IN EINEM ROHR MIT RECHTWINKLIGER ABZWEIGUNG]
H. P. Mehlin and M. Froboese Dec. 1974 36 p refs In GERMAN; ENGLISH summary Sponsored jointly by Bundesmin. fuer Verteidigung and Direc. Tech. des Eng. Prepared jointly with Inst. Franco-Allemand de Rech.
(Rept-6/74) Avail: Issuing Activity

Experiments for generating blast waves of very high intensity were performed in an explosive driven shock tube by firing bars of Hexolit 1 m in length and 15 to 30 mm in diameter. The shock tube has a length of 63 m and a diameter of 29 cm. A lateral tube of equal diameter is flanged to the main tube at right angle. The maximum overpressure obtained shortly upstream of the branch was about 12 to 40 bar depending on the diameter of the bar of explosive. Recordings of the pressure-time history of the wave at the walls of the tube show the variations of the blast wave profile along the track of propagation upstream as well as downstream of the branch. The numerical evaluation in connection with further similar experimental work is expected to give a basis for the determination of simple model relations for the calculation of real shelter galleries of similar layout. Author (ESRO)

N75-28370*# Colorado State Univ., Fort Collins. Dept. of Mechanical Engineering.
FLAT PLATE ELECTROHYDRODYNAMIC HEAT PIPE EXPERIMENTS
R. I. Loehrke and D. R. Sebits Jul. 1975 44 p refs
(Grant NGR-06-002-127)
(NASA-CR-137707) Avail: NTIS HC $3.75 CSCL 20M

Performance capabilities of electrohydrodynamic (EHD) flat heat pipes were investigated using Freon 113 and Freon 11 as working fluids. All of the pipes employed straight rod electrodes to form axial liquid flow channels and tranverse grooves for capillary surface wetting. Results show: (1) the EHD pipe will prime under load, (2) voltage controlled conductance can be achieved by varying the active area of the evaporator, and (3) the average evaporator conductances measured in these experiments were consistent with those obtained in other experiments with heat pipes of similar surface geometry using the same or similar working fluids. Author

N75-28371*# Michigan Univ., Ann Arbor.
DESIGN AND PERFORMANCE OF THE UNIVERSITY OF MICHIGAN 6.6-INCH HYPERSONIC WIND TUNNEL
James L. Amick Washington NASA Jul. 1975 80 p refs
(Grant NGR-23-005-600)
(NASA-CR-2569) Avail: NTIS HC $4.75 CSCL 20D

The tunnel described has several design features intended to maintain laminar flow in the boundary layer of its nozzle. Measurements show that transition to turbulence in the nozzle wall boundary layer begins at the throat and is sensitive to surface roughness, heat transfer rate, and longitudinal radius of curvature. The observed dependence of transition on heat transfer rate is the reverse of that predicted by stability theory for infinitesimal disturbances. Tests include boundary layer surveys of a contoured nozzle and a conical nozzle with four interchangeable throats. Author

N75-28372*# Polytechnic Inst. of New York, Brooklyn. Dept. of Mechanical Engineering.
DYNAMIC INSTABILITY OF DUCTS CONVEYING FLUID Final Technical Report, 1974 - 1975
Yi-yuan Yu Aug. 1975 13 p refs
(Grant NsG-1105)
(NASA-CR-143205) Avail: NTIS HC $3.25 CSCL 20D

A finite element analysis was used to study dynamic instability in ducts conveying high speed fluids. Ducts examined include cantilevered curved, flexibly supported, arbitrarily shaped, and composite duct systems. Partial differential equations were used to study the duct systems. E.H.W.

N75-28373*# Old Dominion Univ. Research Foundation, Norfolk, Va.
VISCOUS-SHOCK-LAYER SOLUTIONS FOR TURBULENT FLOW OF RADIATING GAS MIXTURES IN CHEMICAL EQUILIBRIUM Final Technical Report
E. C. Anderson and James N. Moss (NASA. Langley Res. Center) Aug. 1975 28 p refs
(Grant NsG-1065)
(NASA-CR-143204; TR-75-T9) Avail: NTIS HC $3.75 CSCL 20D

The viscous-shock-layer equations for hypersonic laminar and turbulent flows of radiating or nonradiating gas mixtures in chemical equilibrium are presented for two-dimensional and axially-symmetric flow fields. Solutions were obtained using an implicit finite-difference scheme and results are presented for hypersonic flow over spherically-blunted cone configurations at freestream conditions representative of entry into the atmosphere of Venus. These data are compared with solutions obtained using other methods of analysis. Author

N75-28374*# Rockwell International Corp., Canoga Park, Calif.
COAXIAL SPRAY ATOMIZATION IN ACCELERATING GAS STREAM Final Report
A. Y. Falk Jun. 1975 52 p refs
(Contract NAS3-17828)
(NASA-CR-134825; R-9753) Avail: NTIS HC $4.25 CSCL 20D

An experimental investigation that determined the effects of an accelerating gas flow on the atomization characteristics of gas/liquid coaxial elements is presented. The liquid was molten wax and the gas was nitrogen. The use of molten wax allowed for a quantitative measure of the resulting dropsize distribution. Test variables included: (1) the length of the accelerating gas test section; (2) the maximum velocity of the accelerating gas; (3) the element design test variables of liquid orifice diameter; (4) liquid injection velocity; (5) gas injection velocity, and (6) the ratio of liquid-to-gas flow. The results of this study indicate that droplet breakup occurs for gas/liquid coaxial elements as a result of the action of an accelerating gas (i.e., the combustion gas) on the liquid droplets. Empirical correlations for both the mass median dropsize and the dropsize distribution are presented. Author

N75-28375*# Scientific Translation Service, Santa Barbara, Calif.
ON THE RESISTANCE MECHANISMS OF FLUIDS AND AIR
Th. VonKarman and H. Rubach Washington NASA Jul. 1975 25 p refs Transl. into ENGLISH from Phys. Z. (West Germany), v. 13, no. 2, 15 Jan. 1912 p 49-59
(Contract NASw-2791)
(NASA-TT-F-16415) Avail: NTIS HC $3.25 CSCL 20D

The von Karman vortex street is shown to be the only stable configuration of counterrotating plane vortices. The relationship $h/l = 0.283$ (h - separation between vortex lines; l - distance between vortices in a line) is derived from a stability analysis and experiments are described which prove the results. Author

N75-28376*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CYCLIC STRESS ANALYSIS OF AN AIR-COOLED TURBINE VANE
Albert Kaufman, Daniel J. Gauntner, and James W. Gauntner Washington Aug. 1975 23 p refs
(NASA-TM-X-3256; E-8237) Avail: NTIS HC $3.25 CSCL 20K

The effects of gas pressure level, coolant temperature, and coolant flow rate on the stress-strain history and life of an

air-cooled vane were analyzed using measured and calculated transient metal temperatures and a turbine blade stress analysis program. Predicted failure locations were compared to results from cyclic tests in a static cascade and engine. The results indicate that a high gas pressure was detrimental, a high coolant flow rate somewhat beneficial, and a low coolant temperature the most beneficial to vane life. Author

N75-28377*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLIGHT TRANSITION DATA FOR ANGLES OF ATTACK AT MACH 22 WITH CORRELATIONS OF THE DATA
Charles B. Johnson and Chritine M. Darden Washington Aug. 1975 29 p refs
(NASA-TM-X-3235; L-10143) Avail: NTIS HC $3.75 CSCL 01A

Boundary-layer transition data for angles of attack from 2.5 to 47 deg from a flight experiment with a cone that reentered at angles of attack up to 75 deg were analyzed and their local flow conditions are presented. The transition data were obtained from both acoustic and electrostatic sensors. The data from the acoustic and electrostatic sensors were correlated by use of three different sets of correlating parameters. For each set of correlating parameters, the transitional and turbulent data from the acoustic and electrostatic sensors were plotted separately. Each of the correlations was compared with a linear curve fit of previous cone-flight data at near zero angle of attack. Results indicate that the data from acoustic sensors falls below the linear curve fits to the flight data and indicates the sensitivity of the sensors. It is shown that the transition data from the electrostatic sensors tends to scatter much more than the data from the acoustic sensors. However, the data from the electrostatic sensors tends to scatter about the linear curve fits based on previous flight data. Author

N75-28378*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
PROGRAM DOCUMENTATION: SURFACE HEATING RATE OF THIN SKIN MODELS (THNSKN)
Jack D. McBryde Apr. 1975 81 p Supersedes Rept-07000
(Contract NAS9-12200)
(NASA-CR-144355; LEC-5523; JSC-09434; Rept-07000) Avail: NTIS HC $4.75 CSCL 20M

Program THNSKN computes the mean heating rate at a maximum of 100 locations on the surface of thin skin transient heating rate models. Output is printed in tabular form and consists of time history tabulation of temperatures, average temperatures, heat loss without conduction correction, mean heating rate, least squares heating rate, and the percent standard error of the least squares heating rates. The input tape used is produced by the program EHTS03. Author

N75-28379*# Massachusetts Inst. of Tech., Cambridge.
ON THE NAVIER-STOKES EQUATIONS WITH CONSTANT TOTAL TEMPERATURE
David Gottlieb and Bertil Gustafsson (Uppsala Univ.) [1975] 34 p refs
(Grant NGR-47-102-001)
(NASA-CR-132664) Avail: NTIS HC $3.75 CSCL 20D

For various applications in fluid dynamics, it is assumed that the total temperature is constant. Therefore, the energy equation can be replaced by an algebraic relation. The resulting set of equations in the inviscid case is analyzed. It is shown that the system is strictly hyperbolic and well posed for the initial value problems. Boundary conditions are described such that the linearized system is well posed. The Hopscotch method is investigated and numerical results are presented. Author

N75-28380*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
VORTEX SHEDDING FROM A BLUNT TRAILING EDGE WITH EQUAL AND UNEQUAL EXTERNAL MEAN VELOCITIES
Paul F. Brinich, Donald R. Boldman, and Marvin E. Goldstein Washington Aug. 1975 28 p refs
(NASA-TN-D-8034; E-8281) Avail: NTIS HC $3.75 CSCL 20D

A flow visualization study showed that strong Karman vortices are developed behind the blunt trailing edge of a plate when the free stream velocities over both surfaces are equal. These vortices tend to disappear when the surface velocities are unequal. This observation provided an explanation for the occurrence and disappearance of the lip noise often present in coaxial jets. Vortex formation and lip noise occurred at a Strouhal number of about 0.2 based on the lip thickness and the average of the external steady-state velocities. Results from theoretical calculations of the vortex formation, based on an inviscid, incompressible analysis of the motion of point vortices, were in good agreement with the experimental observations. Author

N75-28381*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRESSURE GRADIENT EFFECTS ON HEAT TRANSFER TO REUSABLE SURFACE INSULATION TILE-ARRAY GAPS
David A. Throckmorton Washington Aug. 1975 67 p refs
(NASA-TN-D-7939; L-10071) Avail: NTIS HC $4.25 CSCL 20M

An experimental investigation was performed to determine the effect of pressure gradient on the heat transfer within space shuttle reusable surface insulation (RSI) tile-array gaps under thick, turbulent boundary-layer conditions. Heat-transfer and pressure measurements were obtained on a curved array of full-scale simulated RSI tiles in a tunnel-wall boundary layer at a nominal free-stream Mach number and free-stream Reynolds numbers. Transverse pressure gradients of varying degree were induced over the model surface by rotating the curved array with respect to the flow. Definition of the tunnel-wall boundary-layer flow was obtained by measurement of boundary-layer pitot pressure profiles, wall pressure, and heat transfer. Flat-plate heat-transfer data were correlated and a method was derived for prediction of heat transfer to a smooth curved surface in the highly three-dimensional tunnel-wall boundary-layer flow. Pressure on the floor of the RSI tile-array gap followed the trends of the external surface pressure. Heat transfer to the surface immediately downstream of a transverse gap is higher than that for a smooth surface at the same location. Heating to the wall of a transverse gap, and immediately downstream of it, at its intersection with a longitudinal gap is significantly greater than that for the simple transverse gap. Author

N75-28382# Little (Arthur D.), Inc., Cambridge, Mass.
THE BEHAVIOR OF LARGE LOW SURFACE TENSION WATER DROPS FALLING AT TERMINAL VELOCITY IN AIR Final Report, 22 Jun. 1970 - 1 Mar. 1974
Robert T. Ryan Mar. 1974 32 p refs
(Contract DAHC04-70-C-0061)
(AD-A005267; ARO-9204-1-EN) Avail: NTIS CSCL 07/4

To study the behavior of large low surface tension drops in free fall a vertical wind tunnel was constructed. The tunnel is simple, but provides a low turbulence (0.7%) flow which stably supports large water drops falling at terminal velocity. The influence of reduced surface tension on maximum drop size, drop terminal velocity and drop shape was investigated. It was found that drops of low surface tension break up at a smaller size than normal surface tension drops, are more deformed than drops of equal mass but normal surface tension and have a lower terminal velocity than drops of equal mass and normal surface tension. Drops only partially coated with surfactant can not be stably supported and undergo violent oscillations. GRA

N75-28383# Ballistic Research Labs., Aberdeen Proving Ground, Md.
EXPERIMENTAL STUDY OF SEPARATION FROM THE BASE OF A CONE AT SUPERSONIC SPEEDS Final Report
Lyle D. Kayser Aug. 1974 136 p refs
(DA Proj. 1T1-61102-A-33D)
(AD-A005015; BRL-1737) Avail: NTIS CSCL 16/2

An experimental investigation of the base region of a 10 degree half-angle cone was conducted at Mach numbers of 1.75 to 4.0 and Reynolds numbers of 1,100,000 to 5,600,000. The following four types of tests were conducted during the investigation: (1) flow visualization studies including surface oil flow, schlieren and shadowgraph; (2) surface pressure measurements; (3) boundary layer surveys; (4) pitot traverses in the separated shear layer near the trailing edge corner. GRA

N75-28384# Tel-Aviv Univ. (Israel). School of Engineering.
***DISTURBANCE PROPAGATION OF A SURFACE OF A VISCOELASTIC FLUID* Final Report, 1 Jan. 1973 - 30 Jun. 1974**
Mordechai Sokolov 15 Nov. 1974 10 p
(Grant AF-AFOSR-2464-73; AF Proj. 9767)
(AD-A005664; EOARD-TR-75-12) Avail: NTIS CSCL 20/4

Experimental studies of the speed of propagation of small disturbance on the surface of a dilute polymer solution is reported. Comparison of this speed for various solvent concentration is also presented. GRA

N75-28385# California Inst. of Tech., Pasadena. Div. of Engineering and Applied Science.
ON THE SINGULARITY INDUCED BY CERTAIN MIXED BOUNDARY CONDITIONS IN LINEARIZED AND NONLINEAR ELASTOSTATICS
James K. Knowles and Eli Sternberg Jan. 1975 62 p refs
(Contract N00014-67-A-0094-0020; NR Proj. 064-031)
(AD-A005436; TR-31) Avail: NTIS CSCL 20/4

This study concerns the local character of the elastostatic field in plane strain near a point that separates a free from an adjoining fixed segment of a rectilinear boundary-component. The well-known singular field behavior predicted by the linear theory, as such a point is approached, exhibits oscillatory deformations and stresses. It is shown here by means of an asymptotic analysis that the foregoing anomalous behavior does not occur within the nonlinear theory of harmonic elastic materials. In preparation for this task certain general aspects of the latter theory are reviewed. The results obtained in the nonlinear asymptotic treatment of the class of mixed boundary-value problems considered are discussed in detail with particular attention to the problem of a bonded flat-ended rigid punch. GRA

N75-28386# Purdue Univ., Lafayette, Ind.
TEMPERATURE, CONCENTRATION AND VELOCITY MEASUREMENTS IN A JET AND FLAME
S. Lederman, J. Bornstein, A. Celentano, and J. Glaser Nov. 1974 41 p refs Prepared in cooperation with Polytechnic Inst. of New York, Farmingdale
(Contract N00014-67-A-0226-00; NR Proj. 098-038)
(AD-A005000; SQUID-TR-PIB-33-PU; PIB-33-PU) Avail: NTIS CSCL 20/4

The applicability of laser diagnostic techniques to flow field measurements is explored. Data obtained on a turbulent jet are compared with more conventional measurements. Specie concentration and temperature measurements were obtained from the ratio of vibrational Stokes to Anti-Stokes intensities using the single pulse Raman scattering technique, and velocity measurements were obtained using a laser Doppler velocitymeter. A preliminary attempt at applying the Raman scattering diagnostic technique to the concentration and temperature measurements in a simulated limited accessibility internal combustion chamber is very promising. Finally, the problem of data acquisition and reduction, and some remarks on the accuracy and precision are given. GRA

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources*. For related information see also *06 Aircraft Instrumentation*, and *19 Spacecraft Instrumentation*.

N75-28387 British Library Lending Div., Boston Spa (England).
INCREASING THE SENSITIVITY OF A THREE-COMPONENT POINT STRAIN GAUGE
G. I. Gulyaev, Ya. N. Matrosov, and G. A. Legavets [1974] 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 3, 1974 p 57-60
(BLL-M-21960-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The advisability of using point strain gauges for determining measured contact stress tolerance limits is discussed. An analytical procedure is presented which provides determination of some of the optimum geometric dimensions for a point strain gauge and its measurable contact stress range. Means of extending this range are recommended. Analytical and graphic relationships are also given between the contact stress measurement tolerances and the ratio of the diameter of the contact surface of the strain gauge and the diameter of that portion of the strain gauge to which the tensoresistors are attached. A method of application is demonstrated for analyzing the capacity of point strain gauges for investigating the contact stress distribution during the cold reduction of tubes. Author

N75-28388 British Broadcasting Corp., Kingswood (England). Research Dept.
A DIRECT READING CHROMATICITY METER
K. Hacking, H. A. S. Philippart, and T. A. Moore Jan. 1975 22 p refs
(BBC-RD-1975/2) Avail: BBC, Kingswood Warren, Tadworth, Surrey, England

The principles and outline design of a tristimulus spot colorimeter, which gives a continuously updated read-out of the chromaticitivy coordinates and luminance of a surface color, are described. The colorimeter can be used to measure automatically the color of the light reflected from a flat surface or emitted by a television screen, and was primarily developed as a research tool for analytical investigations. A chromatic accuracy of 0.005 CIE-UCS units was achieved together with an absolute luminance accuracy of + or - 5%. Digital signal processing is used and the read-out is available in either of the standard (x,y) or (u,v) coordinates. In the principle mode of operation the readings are automatically updated every 1.2 seconds. Author

N75-28389 British Library Lending Div., Boston Spa (England).
CALORIMETRIC APPARATUS FOR STUDYING OPTICAL ABSORPTION IN ULTRA LOW LOSS MATERIALS FOR OPTICAL FIBRES
A. Zaganiaris and G. Bouvy 9 Dec. 1974 15 p refs Transl. into ENGLISH from Verres refract. (France), v. 28, no. 3, May - Jun. 1974 p 113-119
(BLL-TRANS-3186-(9022.81)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons CSCL 14B

A method was developed to find the share of absorption in total attenuation and to measure the absorption coefficient as a function of wavelength. The method is valid for nonfluorescent absorbent media in which the ions excited by the incident light drop back spontaneously to the base level without emitting any photons, and the energy absorbed is converted completely into heat. Measuring the temperature rise which results from this provides information on the capacity of the body to absorb light. The theoretical investigation and experimental technique are described in detail along with sources of error. M.J.S.

N75-28390# Materials Research Labs., Maribyrnong (Australia).
MODIFICATION OF A VAPOUR PRESSURE OSMOMETER
C. E. M. Morris and R. A. Humphreys Nov. 1974 15 p refs
(Rept-616) Avail: NTIS HC $3.25

The performance of a Hewlett-Packard vapor pressure osmometer, model 302B, used for the determination of number average molecular weight, was found to be unsatisfactory in that the instrument showed poor reproducibility and excessive drift. An investigation of the design indicated that these problems arose chiefly from a combination of thermal emfs and poor contacts. The electronics were modified to minimize the stray thermal, and noise potentials, reduce thermal dissipation, and move the balancing potential to a higher level. The performance of the instrument was improved by these modifications. Author

N75-28391# Instituto de Investigaciones Cientificas y Tecnicas de las Fuerzas Armadas (CITEFA), Buenos Aires (Argentina).
FUNDAMENTALS OF OPTICAL HOLOGRAPHY
Jorge E. A. Toni, Raul JimenezRebagliati, and Jose M. Astigueta Apr. 1975 37 p refs In SPANISH; ENGLISH summary
(Rept-180) Avail: NTIS HC $3.75

A series of basic principles of optical holography are

presented. A theoretical and experimental analysis of the holographic process was performed. The requirements, differences with conventional photography and general properties of the hologram are treated. A classification of the different types of holograms, including the characteristics of holography according to the geometry of the optical system or the nature of the object was studied. The different classes of volume, image and phase holograms are discussed. Author

N75-28392*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FORMULATION OF THE INFORMATION CAPACITY OF THE OPTICAL-MECHANICAL LINE-SCAN IMAGING PROCESS
Friedrich O. Huck and Stephen K. Park Washington Aug. 1975 35 p refs
(NASA-TN-D-7942; L-10118) Avail: NTIS HC $3.75 CSCL 14B

An expression for the information capacity of the optical-mechanical line-scan imaging process is derived which includes the effects of blurring of spatial, photosensor noise, aliasing, and quantization. Both the information capacity for a fixed data density and the information efficiency (the ratio of information capacity to data density) exhibit a distinct single maximum when displayed as a function of sampling rate, and the location of this maximum was determined by the system frequency-response shape, signal-to-noise ratio, and quantization interval. Author

N75-28393*# Lockheed Electronics Co., Houston, Tex.
SCANNING SYSTEM, INFRARED NOISE EQUIVALENT TEMPERATURE DIFFERENCE: MEASUREMENT PROCEDURE
J. B. Cannon, Jr. Feb. 1975 11 p refs
(Contract NAS9-12200)
(NASA-CR-141940; LEC-5484; JSC-09689) Avail: NTIS HC $3.25 CSCL 17E

A procedure is described for determining the noise equivalent difference temperature for infrared electro-optical instruments. The instrumentation required, proper measurements, and methods of calculation are included. Author

N75-28394*# Physical Dynamics, Inc., Berkeley, Calif.
LASER DOPPLER VELOCIMETER SYSTEM SIMULATION FOR SENSING AIRCRAFT WAKE VORTICES. PART 2: PROCESSING AND ANALYSIS OF LDV DATA (FOR RUNS 1023 AND 2023) Final Report
J. C. S. Meng and J. A. L. Thomson Feb. 1975 88 p refs
(Contract NAS8-28984)
(NASA-CR-120758; PD-75-077-Pt-2) Avail: NTIS HC $4.75 CSCL 14B

A data analysis program constructed to assess LDV system performance, to validate the simulation model, and to test various vortex location algorithms is presented. Real or simulated Doppler spectra versus range and elevation is used and the spatial distributions of various spectral moments or other spectral characteristics are calculated and displayed. Each of the real or simulated scans can be processed by one of three different procedures: simple frequency or wavenumber filtering, matched filtering, and deconvolution filtering. The final output is displayed as contour plots in an x-y coordinate system, as well as in the form of vortex tracks deduced from the maxima of the processed data. A detailed analysis of run number 1023 and run number 2023 is presented to demonstrate the data analysis procedure. Vortex tracks and system range resolutions are compared with theoretical predictions. Author

N75-28395*# Physical Dynamics, Inc., Berkeley, Calif.
LASER DOPPLER VELOCIMETER SYSTEM SIMULATION FOR SENSING AIRCRAFT WAKE VORTICES. PART 3: THE PROBLEM OF REFLECTION FROM THE SECONDARY MIRROR
J. A. L. Thomson Mar. 1975 28 p ref
(Contract NAS8-28984)
(NASA-CR-120759; PD-75-078-Pt-3) Avail: NTIS HC $3.75 CSCL 14B

Calculations are carried out to investigate the effects of obscuring the central portion of the secondary mirror. Two cases are treated: (1) a Gaussian distribution of reflectivity, and (2) a sharp-edged obscuration. Substantial reduction in reflection from the secondary mirror is found achievable, but the reduction was found highly sensitive to the form of the radial distribution of reflectivity. The total power reflected from the secondary mirror that is incident on the detector is estimated. Techniques for experimental testing of alleviation schemes are suggested. Author

N75-28396*# Technicolor Graphic Services, Inc., Houston, Tex.
SKYLAB MISSIONS SL/1, 2, 3, 4 PHOTOGRAPHIC PROCESSING CONTROL PLAN
[1975] 7 p refs
(Contract NAS9-11500)
(NASA-CR-141919) Avail: NTIS HC $3.25 CSCL 14E

The control parameters to be used by the Photographic Technology Division for the processing of films flown on Skylab Missions SL/1, 2, 3, and 4 are defined. The sensitometric exposure and processing conditions PTD plans to use and the procedures necessary for general film certification are described. Author

N75-28397*# Technicolor Graphic Services, Inc., Houston, Tex.
APOLLO 17 PHOTOGRAPHIC PROCESSING CONTROL DOCUMENT
Mark S. Weinstein 16 Nov. 1972 8 p refs
(Contract NAS9-11500)
(NASA-CR-141921; JL12-301) Avail: NTIS HC $3.25 CSCL 14E

The control parameters are defined which are to be used by the Photographic Technology Division for the processing of all films flown on Apollo Mission J-3. The procedures necessary for establishment of processing control are given along with information for denoting and solving any problem areas or conflicts which may occur prior to the mission. Author

N75-28398# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET MATERIAL ON RADIATION DETECTION, 1972 - 1974
John Kourilo 31 Jan. 1975 52 p refs
(Contract N00600-75-C-0018; DARPA Order 2790)
(AD-A005564) Avail: NTIS CSCL 18/4

This is a bibliography of Soviet open-source material on radioactivity detection and measurement techniques, covering the period from 1972 through 1974. Entries are listed alphabetically by author; a source abbreviation list for serial publications is appended. GRA

N75-28399# Harry Diamond Labs., Washington, D.C.
DESIGN AND FABRICATION OF A THIN-FILM RATIOMETER FOR ELECTRONIC TIMER OF XM732 PROXIMITY FUZE
Lester A. Kitchman, Gwendolyn B. Wood, John P. Swirczynski, Lauren H. Bullis (Library of Congress), and Emma Lee Hebb Dec. 1974 30 p refs Sponsored by Army
(AD-A005615; HDL-TM-74-24) Avail: NTIS CSCL 19/1

A feasibility study was conducted on the design and fabrication of a thin-film precision ratiometer developed for use in the electronic timer of the XM732 Short Intrusion Proximity Fuse. The ratiometer network consists of a 432-kohm linear variable resistor and a 3-kohm fixed resistor that provides a means of setting a delay time of 2 to 144 sec before fuse turnon. Nichrome and gold were vacuum deposited onto a glazed ceramic substrate with the resistor-conductor pattern being selectively etched. This approach utilizes a step-like conductor/commutator design that permits settability within 0.5 sec through a movable spring contact. Resistor tolerances of plus or minus 20 percent with a linearity of plus or minus 1.5 ratio units through an angle of 324 deg were demonstrated. GRA

N75-28400# Harry Diamond Labs., Washington, D.C.
A FLUX CIRCUIT ANALYSIS FOR THE MAGNETIC TRANSDUCER OF A FLUIDIC REED GENERATOR
Herbert A. Leupold, Frederick Rothwarf, Doyle Edmiston, Carl J. Campagnoulo, and Henry Lee Jan. 1975 55 p Sponsored by ECOM
(DA Proj. 1W6-63613-DE-55)
(AD-A005222; ECOM-4284) Avail: NTIS CSCL 19/1

A mathematical analysis was made of the magnetic circuit of a fluidic generator to be used in various fusing applications. A method for obtaining the approximate power output of a

prototype generator as a function of the relevant geometric parameters was developed, and sample calculations were made for some typical values of these parameters. In the present design the calculations show that both the vibrating reed and part of the magnet keeper are magnetically saturated under projected operating conditions with the result that only about 35% of the potential power output is actually realized. Author (GRA)

N75-28401# Utah State Univ., Logan. Center for Research in Aeronomy.
ROCKETBORNE DIAGNOSTIC INSTRUMENTATION FOR AN EXPERIMENT TO CONTROL VEHICLE POTENTIAL Final Report, 1 Aug. 1971 - 1 Nov. 1974
David A. Burt Nov. 1974 41 p refs
(Contract F19628-72-C-0012; AF Proj. 6813)
(AD-A005239; AFCRL-TR-74-0346) Avail: NTIS CSCL 14/2

Two payloads intended to control rocket to plasma potentials were designed and flown. Each payload contained an electron gun to control the vehicle potential by discharging electrons into the plasma. Space Science laboratory designed and fabricated the Langmuir probes, skin current probes and thermal emission probes used to measure vehicle potential and also to perform other diagnostic functions. Results from the first flight were used to modify the instrumentation for the second flight. Good data were received on the second flight and preliminary analysis indicates some additional improvements to the instrumentation would make future flights more useful in controlling and studying vehicle to plasma potentials. Author

N75-28402# Army Foreign Science and Technology Center, Charlottesville, Va.
SILVER ACETYLIDE PHOTOGRAPHIC EMULSIONS IN VARIOUS MEDIA
V. D. Stashonok and M. E. Skurko 10 Mar. 1974 9 p refs
Transl. into ENGLISH from Dokl. Akad. Nauk. BSSR (Minsk), v. 13, no. 4, 1969 p 337-339
(AD-A004924; FSTC-HT-23-1360-73) Avail: NTIS CSCL 14/5

Ag2C2 emulsions in gelatin, polyvinyl alcohol, and collodion were studied to determine the effect of the degree of saturation with acetylene. For all three types, photosensitivity, fog, and contrast were plotted as functions of development time. The gelatin and polyvinyl alcohol emulsions were generally similar, while the collodion emulsions had the highest photosensitivities and developed fastest. GRA

N75-28403# Army Foreign Science and Technology Center, Charlottesville, Va.
SELECTION OF AN OPTIMUM DEVELOPER IN THE PROCESSING OF AERIAL PHOTOFILMS
V. M. Bakhvalov and T. V. Utkina 29 Mar. 1974 6 p refs
Transl. into ENGLISH from Zh. Nauch. Prikl. Fotogr. Kinematogr. (USSR), v. 15, 1970 p 207-208
(AD-A004921; FSTC-HT-23-1328-73) Avail: NTIS CSCL 14/5

An experimental investigation was made of the characteristics of several developers in the processing of T-15 and T-17 aerial films for a gamma of 1.4 plus or minus 0.05. The results of a comparison of the developers with respect to several parameters are used to estimate the relationships between the light sensitivity and information capacity. The parameters of five developers are tabulated for each of the films. GRA

N75-28404# Army Aviation Systems Test Activity, Edwards AFB, Calif.
ICING TUNNEL TEST: HOT-FILM ANEMOMETER Final Report
Paul R. Bonin and Robert P. Jefferis Feb. 1974 26 p refs
(AD-A005044; USAASTA-73-04) Avail: NTIS CSCL 14/2

A limited test is reported of a Thermo-Systems Inc. series 1050 constant-temperature hot-film anemometer system in the Lockheed-California Company icing research tunnel to determine its suitability as a detector of discrete water droplets and liquid water content in natural and artificial icing clouds. It was determined that the hot-film anemometer was capable of recording individual droplet encounters but that the signal processing equipment required modifications to prevent errors due to noise, saturation, and frequency response. Recommendations include improved signal processing electronics and precautionary procedures to enhance anemometer survivability. GRA

N75-28405# Andros, Inc., Berkeley, Calif.
REVIEW OF PROGRESS TOWARDS DEVELOPING A SENSOR FOR THE MEASUREMENT OF CO2 IN HYPERBARIC GASEOUS ENVIRONMENTS
Kevin G. Williams Jan. 1975 23 p refs
(Contract N00014-74-C-0240; NR Proj. 291-062)
(AD-A005582) Avail: NTIS CSCL 14/2

The development of a small, accurate and reliable alarm sensor to monitor the partial pressure of CO2 (pCO2) in the hyperbaric gaseous environment of the saturation diver is required to prevent his exposure to dangerous levels of CO2. Andros Incorporated has developed a novel, nondispersive infrared (NDIR) density modulation technique meeting all the previously mentioned requirements. Using the technique, the number of CO2 molecules in the radiation path is varied periodically by subjecting a sample of the gas to a known density modulation and then measuring the fractional change in transmitted infrared radiation. Response and design are discussed. GRA

N75-28825* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN X-RAY SHADOWGRAPH TO LOCATE TRANSIENT HIGH-ENERGY CELESTIAL SOURCES
G. J. Fishman, T. A. Parnell, T. A. Rygg (Alabama Univ., Huntsville), and J. C. Gregory (Alabama Univ., Huntsville) *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 4-13 refs (For availability see N75-28824 19-70)
CSCL 03A

36 LASERS AND MASERS

Includes parametric amplifiers.

N75-28406 British Library Lending Div., Boston Spa (England).
ON THE INFLUENCE OF LIDAR GEOMETRICAL PARAMETERS ON THE APPLICABILITY OF THE SINGLE-SCATTERING APPROXIMATION
B. M. Golubickij, T. M. Zadko, and M. V. Tantasev [1974] 6 p refs Transl. into ENGLISH from Izv. Akad. Nauk. SSSR, Fiz. Atmosfery i Okeana (Moscow), v. 8, 1972 p 1226-1229
(BLL-M-23569-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Impulse laser technology was used to study the physical characteristics of clouds by optical sounding. The limits are discussed of the applicability of the single-scattering approximation (on which the use of the optical locator is based) as it depends on distance from the scattering layer, the depth of ray penetration into the layer, and the lidar geometrical parameters. Computations were performed using the Monte Carlo method. Author

N75-28407 British Library Lending Div., Boston Spa (England).
FOURIER ANALYSIS OF LASER-BASED DOPPLER DEVICES
G. A. Barill, Yu. G. Vasilenko, Yu. N. Dubnishchev, and V. P. Koronkevich 29 Aug. 1974 6 p refs Transl. into ENGLISH from Avtometriya. (USSR), no. 5, Sep.-Oct. 1973 p 41-47 In ENGLISH and RUSSIAN
(BLL-NEL-TT-25'96-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The optical systems of the laser dopplermeter (LDM) are described showing the interference field formed by coherent beams is shifted into the region under investigation of the stream of scattering particles, whose velocity it is desired to determine. This produces in the plane of the photodetector a superimposition of the field diffracted from a particle upon that of the incident beams. The resultant field contains information on the velocity of the scattering agent. The structure of the signal output is investigated by the methods of Fourier optics, taking into account the parameters of the laser, the particle dimensions and the aperture of the photodetector. Author

N75-28408*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN IMPROVED METHOD FOR MEASURING THE MAGNETIC INHOMOGENEITY SHIFT IN HYDROGEN MASERS
Victor S. Reinhardt and Harry E. Peters May 1975 12 p refs
Presented at 29th Frequency Control Symp., Atlantic City, 28-30 May 1975 Submitted for publication
(NASA-TM-X-70928; X-814-75-132) Avail: NTIS HC $3.25 CSCL 20E

A magnetic inhomogeneity shift which alters a hydrogen maser's flux tuned frequency, and affects hydrogen maser accuracy as well as long term stability was studied. A method is presented which allows all maser frequency measurements to be made at low magnetic field where the hydrogen maser is most stable.
Author

N75-28409# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET LASER DEVELOPMENTS, NO. 17, JULY - SEPTEMBER 1974
Stuart G. Hibben 29 Jan. 1975 111 p refs
(Contract N00600-75-C-0018; DARPA Order 2790)
(AD-A005566) Avail: NTIS CSCL 20/5

This is the Soviet Laser Bibliography for the third quarter of 1974 and is No. 17 in the series on Soviet laser developments. The coverage includes basic research on solid state, liquid, gas, and chemical lasers; components; nonlinear optics; spectroscopy of laser materials; ultrashort pulse generation; crystal growing; theoretical aspects of advanced lasers; and general laser theory. Laser applications are listed under biological effects; communications; computer technology; holography; laser-induced chemical reactions; instrumentation and measurements; beam-target interaction; and plasma generation and diagnostics. GRA

N75-28410# Aerospace Corp., El Segundo, Calif. Lab Operations.
ATOMIC LASER ACTION IN RARE GAS-SF6 MIXTURES
David G. Sutton, Luis Galvan, Pierre R. Valenzuela, and Steven N. Suchard 28 Jan. 1975 20 p refs
(Contract F04701-74-C-0075)
(AD-A005706; TR-0075(5641)-3; SAMSO-TR-74-276) Avail: NTIS CSCL 07/4

Pulsed laser action was observed on a total of seven laser transitions in Ar, one of which has not been previously reported. In pure Ar, only one transition was observed; however, the other six transitions were observed to lase simultaneously upon the addition of SF6 to the discharge in Ar. These six transitions form a highly coupled system between three upper (3d) and three lower (4p) levels of the Ar. The addition of less than 0.2 Torr SF6 to 49 Torr He results in lasing on the F(I) transition at 0.7129 micrometers. However, the addition of several Torr SF6 to 49 Torr He produces an unidentified oscillation at 2.639 micrometers. These last two transitions have also been observed to lase in He-NF3, He-CF4, and He-PF3 mixtures. GRA

N75-28411# University of Southern Calif., Los Angeles. Dept. of Chemistry.
HIGH ENERGY LASER PULSE PHOTOLYSIS OF COORDINATION COMPOUNDS Final Technical Report
Arthur W. Adamson Feb. 1975 17 p
(Contract N00014-67-A-0269-0033)
(AD-A005646) Avail: NTIS CSCL 07/5

The report briefly discusses research activities related to high energy laser pulse photolyses of coordination compounds. Experimental considerations and difficulties are discussed. GRA

N75-28412# Aerospace Corp., El Segundo, Calif. Lab Operations.
QUASI-CONTINUOUS-WAVE LASER EMISSION FROM THE SECOND POSITIVE BAND OF NITROGEN Interim Report
Steven N. Suchard, Luis Galvan, and David G. Sutton 28 Jan. 1975 15 p refs
(Contract F04701-74-C-0075)
(AD-A005707; TR-0075(5641)-6; SAMSO-TR-75-32) Avail: NTIS CSCL 20/5

Experimental results are presented for the observation of a second positive nitrogen laser that has a pulse length much longer than the radiative lifetime of the upper laser level. Preliminary measurements of the temporal behavior of this laser indicate that it was operating in a quasi-continuous-wave manner and, in addition, the laser output was extremely sensitive to the alignment of the optical cavity placed around the discharge tube. GRA

N75-28413# Avco-Everett Research Lab., Everett, Mass.
LASER IRRADIATION EXPERIMENTS Final Report
Jan. 1975 8 p
(Contract N00014-75-C-0108; ARPA Order 2439)
(AD-A005663) Avail: NTIS CSCL 20/5

The Humdinger Jr. device was run in order to perform laser irradiation experiments in order to determine the steady-state thermal blooming of a train of focused laser pulses in a uniform crosswind as a function of beam overlap and strength of the index of refraction disturbance caused by a single pulse. GRA

N75-28414# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
AIRBREATHING LASER PROOF EXPERIMENT Final Report, 6 Jun. - 16 Sep. 1974
R. W. Gordon and J. M. McCloskey 31 Jan. 1975 55 p refs
(Contract DAAH01-74-C-0751)
(AD-A005652; PWA-FR-6638) Avail: NTIS CSCL 20/5

An experimental test program to measure the predicted performance of a gas dynamic laser burning benzene, toluene, and kerosene in preheated air can be realized is described. Small signal gain and power extraction measurements were made with each of the three hydrocarbon fuel-air combinations and compared with predicted values. The combustor was monitored for smoke-free operation by measurement of the attenuation of a 3.391 micron beam in the optical cavity. The combustor, originally designed to burn gaseous CO/H2/O2/N2 reactants, was redesigned and retrofitted for smokeless burning of the liquid hydrocarbons with preheated air. Small signal gain up to 0.484-/cm and output power up to 22.6 kw were measured.
GRA

N75-28415# Exxon Research and Engineering Co., Linden, N.J. Government Research Lab.
HEAT PIPE COPPER VAPOR LASER Final Report, 1 Feb. 1973 - 30 Jun. 1974
Robert J. L. Chimenti Nov. 1974 45 p refs
(Contract N00014-73-C-0317; ARPA Order 1806)
(AD-A005004; GRU-2BEOA-74) Avail: NTIS CSCL 20/5

The program objective was the development of a copper vapor laser in which the copper was contained within a heat pipe and whose vapor density could be controlled by an inert gas. Successful operation of a heat pipe with graphite and tungsten as the materials of construction was obtained to temperatures of 2100C. Both helium and argon were used for the control of the copper vapor pressure. The second aspect of the program was the development of a discharge configuration capable of the production of high current, short risetime excitation in the vapor and compatible with the heat pipe structure. Pulse generators were developed which were integral with the laser structure and had variable pulse repetition rates from one to 10,000 pulses per second. In the third part of the program investigation of laser action obtained in the heat pipe was carried out. Laser action at both 5106 micrometers and 5782 micrometers was successfully demonstrated at temperatures between 1500C and 1900C. Multiple laser pulses resulting from a single excitation pulse have been observed at temperatures above 1700C with pulse widths less than 2.5 nsec (bandwidth limited). GRA

N75-28416# Martin Marietta Aerospace, Orlando, Fla.
SINGLE ENGAGEMENT LASER SEMIACTIVE SYSTEM Final Report
Jun. 1974 61 p
(Contract DAAH01-74-C-0411)
(AD-A005667; OR-13177) Avail: NTIS CSCL 16/4

This report documents a study to reexamine the technology of laser semiactive guidance. The objective was to find methods of accomplishing high terminal guidance accuracy with minimum complexity. All three principle system elements were examined: laser designator, the seeker, and the missile control system. While this study chose a general case ballistic ground-to-ground missile

as the application, most of the conclusions apply to other missile systems as well. GRA

N75-28417# Army Electronics Command, Fort Monmouth, N.J.
LASER RANGEFINDER, AN/GVS-5 (XE-2) Final Report
Richard J. Newton, Frederick A. Kobylarz, Richard D. Brady, and Richard P. Tuttle Sep. 1974 34 p
(DA Proj. 1S6-62704-A-199)
(AD-A005275; ECOM-4256) Avail: NTIS CSCL 17/5

The report describes the effort to design, fabricate, and test a hand-held laser rangefinder weighing less than 5 pounds. The effort was initiated in early 1970 when the technology had achieved a potential for success. The use of Nd:YAG in the laser transmitter (which requires less input energy than previous rangefinders using a ruby transmitter) and the development of a highly sensitive, temperature compensated, silicon avalanche receiver permitted a tenfold reduction in weight of the battery, power supply, pulse forming network and the laser transmitter as compared to previous designs. In addition, a further significant reduction in weight was obtained by the use of Medium Scale Integrated (MSI) electronics in hybrid packages for the majority of circuitry used in the rangefinder. In late 1972 fabrication and testing of three XE-2 model rangefinders was completed. The XE-2 uses a 7 x 50 optical system, weighs 4 3/4 pounds, and ranges to 10 km with an error of plus or minus 10 m. GRA

N75-28418# Radio Corp. of America, Burlington, Mass.
AlGaAs SEMICONDUCTOR LASER ILLUMINATOR Final Report
William W. Barratt, Elliott C. Lea, and Larry S. OHara Jun. 1974 62 p refs
(Contract DAAK02-72-C-0390)
(AD-A005655) Avail: NTIS CSCL 20/5

This program was directed at development of an acoustically covert, non-cryogenically cooled AlGaAs Semiconductor Laser Illuminator compatible with night vision equipment. The arraying approach undertaken for development used micro-cylindrical lenses attached to the face of the laser diodes and imaging the 2.5 micron junction. A conventionally drawn glass fiber was used for this lens. A solid glass integrator with a 3 to 1 taper ratio was used to compress the fan beams from the array into a 0.30 x 0.10 inch rectangular source for final projection by an F/1.0 projection lens. Alignment and attachment techniques of the micro lenses were developed allowing repeatable and reliable mounting in large scale arrays. The array was temperature stabilized by a high capacity single stage thermoelectric cooler. Heat exchange of the array, thermoelectric and driver dissipation was accomplished by a low noise (- 40 db) fan and large area heat exchanger. GRA

N75-28419# Sanders Associates, Inc., Nashua, N.H. Electro-Optics Div.
DEVELOPMENT OF MULTIPLY SENSITIZED HO:YLF AS A LASER MATERIAL Final Report, 15 Dec. 1972 - 15 Jan. 1974
Evan P. Chicklis, Robert C. Folweiler, Charles S. Naiman, D. R. Gabbe, and Arthur Linz Oct. 1974 130 p refs
(Contract DAAB07-73-C-0066; ARPA Order 1868)
(AD-A005627; YWN(5126)-Rev-1; ECOM-73-0066F) Avail: NTIS CSCL 20/5

The results of a 12 month program to develop multiply sensitized Ho:YLF as a Q-switched laser material are presented. This material is the only material in which efficient laser operation at 2 micrometers has been reported at room temperature. Crystals were grown by the Top-Seeded Solution Technique, a modification of the Czochralski process. Extensive analysis of the effects of feed purity and growth technique on the crystalline quality and damage susceptibility of this material are presented. Extensive spectroscopic measurements are reported with direct observation of sensitization quantum yields of three; the implications for optimization of the material for specific applications are discussed. Q-switched operation of different material compositions is reported (calcite with LiNbO3). The composition 50% Erbium, 6.7% Thulium, 0.34% Holmium has exhibited a 6.5 joule threshold and a 2.5% slope efficiency. A calculation of the thermal loading at fracture of a uniformly heated rod cooled at the surface is presented. GRA

N75-28420# School of Aerospace Medicine, Brooks AFB, Tex.
LASER ENERGY EVALUATOR (LEE): LABORATORY AND FIELD TESTS Final Report, Oct. 1972 - Jun. 1974
Jack A. Labo, Donald R. Marston, and Peter C. Laudieri Dec. 1974 20 p
(AF Proj. 7784)
(AD-A005294; SAM-TR-74-50) Avail: NTIS CSCL 20/5

The Laser Energy Evaluator (LEE) is intended for use by Air Force laser safety personnel to: (1) confirm Safe Eye Exposure Distance (SEED) calculations by direct measurement, (2) test for possible hazardous reflections from an operating laser system, and (3) facilitate laser hazard surveys as required by AFR 161-24. The calibration tests showed that the LEE measured laser output intensities on the same order as the Permissible Exposure Levels to within plus or minus 10% of each energy or power scale reading. The user tests show that the LEE could be used as a field device, but has some inherent limitations. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (non-power); machine elements and processes; and mechanical equipment.

N75-28421 British Library Lending Div., Boston Spa (England).
CHANGE IN PRESSURE AS A FUNCTION OF THE CONTACT FRICTION AND AMOUNT OF DEFORMATION DURING DRAWING IN PLANE DIES
N. A. Chelyshev and K. M. Kolmakov [1974] 6 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 8, 1974 p 55-57
(BLL-M-25056-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The results of the experimental drawing of strip in plane dies are presented. Friction, as it influences pressure, is discussed. Author

N75-28422 British Library Lending Div., Boston Spa (England).
USE OF GAS TURBINE DRIVE WITH FREE PISTON GAS GENERATOR FOR OIL AND GAS WELL DRILLING
A. Z. Mirkin [1974] 5 p refs Transl. into ENGLISH from Neft. Khoz. (Moscow), v. 46, no. 3, 1968 p 1-3 In ENGLISH and RUSSIAN
(BLL-NEL-TT-2607-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Gas turbine drive with free piston engines is described along with its operating features. Diesel units, gas turbine units with combustion chambers, and gas turbine units with free piston gas generators are compared. M.J.S.

N75-28423 Missouri School of Mines and Metallurgy, Rolla.
A STUDY OF THE DYNAMIC LOADING OF HYDRODYNAMICALLY LUBRICATED JOURNAL BEARINGS Ph.D. Thesis
Nader Khorzad 1974 111 p
Avail: Univ. Microfilms Order No. 75-15829

The analytical and experimental investigation presented examines the response of a full journal bearing to a unidirectional dynamic load. Frequency response of the bearing at different eccentricity ratios is investigated. It was concluded that the response of the bearing varies with eccentricity. The experimental data obtained was compared to an analytical model which considered inertial, damping, and elastic characteristics of the lubricant film. An investigation of film pressure revealed that the pressure due to journal center acceleration is smaller than the hydrodynamic and squeeze-film pressures. Dissert. Abstr.

N75-28424 Illinois Univ., Urbana.
FEEDBACK CONTROL OF A LARGE STEAM GENERATOR USING VECTOR PERFORMANCE INDEX Ph.D. Thesis
Larry William Kirsch 1975 189 p
Avail: Univ. Microfilms Order No. 75-14129

Feedback control of a large counter current heat exchanger employed as a once-through steam generator for a nuclear power plant is presented. The mathematical model of the exchanger consists of a set of nonlinear partial differential equations with boundary conditions specified at three space points. The system structure does not allow the actuating signals to be distributed

in space; they are applied only at the boundary points. A practically implementable time-invariant feedback controller which would give satisfactory regulation of the system is discussed. A meaningful feedback configuration is chosen through detailed simulation of the nonlinear model of the steam generator on a hybrid computer using the continuous space-discrete time (CSDT) method. It is found that the determination of steam generator responses using the CSDT procedure results in significantly large computing times (making this method uneconomical for the control system optimization studies). The method of modal analysis was used to develop a more efficient steam generator model. Dissert. Abstr.

N75-28425 Illinois Univ., Urbana.
HIGH TEMPERATURE DEFORMATION BEHAVIOR OF CEMENTED CARBIDE CUTTING TOOLS Ph.D. Thesis
Joseph Gary Baldoni, II 1975 181 p
Avail: Univ. Microfilms Order No. 75-14078

Sections of commercial cemented carbide metal cutting tools, both straight WC-Co and multi-carbide-Co, were tested at high temperature, in vacuo, in uniaxial compression. For stresses up to 50 Kg/sq mm and temperatures below approximately 1050 C the materials were found to show elastic response. In the temperature range of 1050 to 1200 C, irreversible deformation was observed at stress levels below 50 Kg/sq mm. The temperature for the onset of this deformation was found to depend upon composition, increasing with increasing amounts of cubic carbide and decreasing cobalt content. After a certain amount of irreversible deformation, the materials again show a linear relationship between stress and strain. The amount of irreversible deformation was found to decrease with increasing cubic carbide additions, decreasing cobalt content, and decreasing temperature. A model based on densification by grain boundary sliding with accompanying plastic deformation in the binder phase and some deformation of carbide grains at points of contact is presented to explain the observations. Dissert. Abstr.

N75-28426# Aeronautical Research Labs., Melbourne (Australia).
VIBRATION MEASUREMENTS OF ACCESSORY ANGLE DRIVE GEARBOXES ON ATAR 090C ENGINES
D. H. Edwards, C. N. King, and R. V. Pavia Nov. 1974 44 p refs
(ARL/ME-144) Avail: NTIS HC $3.75

As an insurance against in-flight failure of the gearboxes driving fuel and hydraulic pumps on Atar engines in R.A.A.F. aircraft, a technique was developed for recording and analyzing gearbox vibration when running under load on an engine, and a vibration survey was conducted on all boxes in the fleet in Australia and Malaysia. A number of boxes were detected with abnormal vibration patterns or high vibration levels, and these were removed for examination and rework. In most cases, some defect was found which needed attention and which in two cases could have led to gearbox failure. A recommendation that vibration testing of all reworked boxes be carried out before they leave the local factory was made and personnel were instructed in the use of measuring equipment bought for that purpose. Statistical analyses of the results of the vibration survey were made to show the effect of some gearbox variables. Other analyses confirmed that the rejection criteria applied during the survey, and those recommended for use on overhauled gearboxes with the instrumentation, were justified on a statistical basis. Author

N75-28427*# AiResearch Mfg. Co., Phoenix, Ariz.
ENGINEERING REPORT: OXYGEN BOOST COMPRESSOR STUDY
L. S. Tera 15 Apr. 1974 12 p
(Contract NAS9-10465)
(NASA-CR-141938; Rept-74-410521A) Avail: NTIS HC $3.25 CSCL 13I

An oxygen boost compressor is described which supports a self-contained life support system. A preliminary analysis of the compressor is presented along with performance test results, and recommendations for follow-on efforts. M.J.S.

N75-28428*# TRW Systems Group, Redondo Beach, Calif.
WELD BONDING OF TITANIUM WITH POLYIMIDE ADHESIVES
R. W. Vaughan, C. H. Sheppard, and M. K. ORell Jun. 1975 73 p refs
(Contract NAS1-11689)
(NASA-CR-132665; TRW-22902-6027-TU-00) Avail: NTIS HC $4.25 CSCL 13H

A conductive adhesive primer and a capillary flow adhesive were developed for weld bonding titanium alloy joints. Both formulations contained ingredients considered to be non-carcinogenic. Lap-shear joint test specimens and stringer-stiffened panels were weld bonded using a capillary flow process to apply the adhesive. Static property information was generated for weld bonded joints over the temperature range of 219K (-65 F) to 561K (550 F). The capillary flow process was demonstrated to produce weld bonded joints of equal strength to the weld through weld bonding process developed previously. Author

N75-28429*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SHORT-TERM HOT-HARDNESS CHARACTERISTICS OF FIVE CASE HARDENED STEELS
Neil E. Anderson and Erwin V. Zaretsky Washington Aug. 1975 19 p refs Prepared in cooperation with Army Air Mobility R and D Lab., Cleveland
(NASA-TN-D-8031; E-8198) Avail: NTIS HC $3.25 CSCL 11F

Short-term hot-hardness studies were performed with carburized and hardened AISI 8620, CBS 1000, CBS 1000M, CBS 600, and Vasco X-2 steels. Case and core hardness measurements were made at temperatures from 294 to 811 K (70 to 1000 F). The data were compared with data for high-speed tool steels and AISI 52100. The materials tested can be ranked as follows in order of decreasing hot-hardness retention: (1) Vasco X-2; equivalent to through-hardened tool steels up to 644 K (700 F) above which Vasco X-2 is inferior; (2) CBS 1000, (3) CBS 1000M; (4) CBS 6000; better hardness retention at elevated temperatures than through-hardened AISI 52100; and (5) AISI 8620. For the carburized steels, the change in hardness with temperature of the case and core are similar for a given material. The short-term hot hardness of these materials can be predicted with + or - 1 point Rockwell C. Author

N75-28430# Naval Ship Research and Development Center, Bethesda, Md.
EFFECTS OF MID-CHORD FLAPS ON THE VENTILATION AND FORCE CHARACTERISTICS OF A SURFACE-PIERCING HYDROFOIL STRUT
John J. Nelka Nov. 1974 59 p refs
(AD-A005381; NSRDC-4508) Avail: NTIS CSCL 13/10

Ventilation and side force characteristics of a NACA 16-012 strut with span-wise mid-chord flaps attached from 0.5 to 0.7 chord were determined. This strut configuration represented a strut system with retractable mid-chord flaps in the extended mode. Experimental results showed that such a strut system exhibits the advantage of a streamline strut at preventilation speeds (low drag) and the advantage of a blunt-based strut at ventilation/post-ventilation speeds (no side force reversal). GRA

N75-28431# Naval Postgraduate School, Monterey, Calif.
THE SIMULATION OF HYDROFOIL PERFORMANCE M.S. Thesis
Jitt Na Nagara Dec. 1974 101 p refs
(AD-A005463) Avail: NTIS CSCL 13/10

The behavior of a fully-submerged hydrofoil has been studied by using Root Locus technique. A multivariable concept was used in designing the compensators of the system. A digital computer simulation program using Digital Simulation Language or DSL is produced to study the performance on the digital computer IBM system 360/67. The Highpoint PC(H)-1 is used as the model of this simulation. GRA

N75-28432# Boeing Co., Seattle, Wash.
HYDROFOIL ANALYSIS AND DESIGN PROGRAM (HANDE), PHASE O Final Report
A. J. Brennan, J. D. Burroughs, W. C. Hurt, E. O. Wichert, and D. Wacker 1974 288 p refs
(Contract N00600-73-C-0450)
(AD-A005487; D221-51302-1) Avail: NTIS CSCL 13/10

A digital computer program, Hydrofoil Analysis and Design (HANDE), for use in the feasibility and early preliminary design

of hydrofoil ships has been defined in detail under Phase O of Contract N00600-73-C-0450. This program includes sixteen integrated, technology oriented computational modules which function under a controlling executive program. A computerized data bank facilitates program input and forms a depository for hydrofoil ship data. All HANDE functions may be performed interactively as well as through batch operation. This document describes in detail the design procedure and approach to be taken in the development and implementation of HANDE. GRA

N75-28433# Boeing Co., Seattle, Wash.
HYDROFOIL ANALYSIS AND DESIGN PROGRAM (HANDE), PHASE O EXTENSION Final Report
A. J. Brennan, J. D. Burroughs, D. H. Wacker, and E. O. Wichert 1974 196 p refs
(Contract N00600-73-C-0450)
(AD-A005488; D321-51303-1) Avail: NTIS CSCL 13/10

This document reports on certain tasks that have been completed on the Hydrofoil ANalysis and DEsign (HANDE) program. Those portions of the HANDE executive and data bank maintenance programs which are required to control the execution of analysis modules are described. Two analysis module subroutines, the Initialization module and the Hull Structural Sizing module, are described and examples of their operation are given. The Initialization module is designed to parametrically generate ship size and configuration parameters for use in the Synthesis Section of HANDE. However, this module may also be used for performing high level trade studies. The Hull Structural Sizing module sizes the hull shell and deck structure to meet specified loading conditions. GRA

N75-28434# Draper (Charles Stark) Lab., Inc., Cambridge, Mass.
HYDROFOIL UNIVERSAL DIGITAL AUTOPILOT (HUDAP), PHASE 2 Final Report, 1 Jul. 1973 - 31 Mar. 1974
Frederick S. Gamber and Roger Medeiros May 1974 254 p
(Contract N00014-74-C-0009)
(AD-A005523; R-817) Avail: NTIS CSCL 13/10

The Hydrofoil Universal Digital Autopilot (HUDAP) Assembly was used to demonstrate the feasibility of using a digital computer as part of an autopilot assembly to control a high performance, submerged foil hydrofoil craft. This report documents the HUDAP development effort and demonstration, the conclusions reached from the development and recommendations for product improvement and expansion. In addition, the configuration of both the hardware and software used in the demonstrations, a delineation of expansion capabilities of the system, and a discussion of several real or potential problem areas are presented. GRA

N75-28435# Naval Surface Weapons Center, White Oak, Md.
DEVELOPMENT OF PERFORMANCE ORIENTED SPECIFICATIONS FOR DRUMS AND PAILS USED FOR PACKAGING OF HAZARDOUS MATERIALS FOR TRANSPORTATION Final Report
C. E. Fridinger, C. V. Vickers, Jr., and J. S. Gott 2 Dec. 1974 105 p refs
(Contract DOT-AS-20065)
(PB-240647/8; DOT-TES-20-74-7) Avail: NTIS HC $5.25 CSCL 13D

The current requirements and tests were obtained by studying DOT regulations and other standards and specifications on drums and pails. Reports on the hazards of shipping and the tests used in the packaging industry were also studied. Hazard classifications, performance requirements and tests, and a container rating system were developed. The rationale behind the development is presented in the report. Test plans for qualification and periodic testing and detailed test procedures were prepared. Tests included were leak, distortion, pressure-proof, repetitive shock (vibration), wet strength-stacking, drop, and puncture tests and a temperature cycle. GRA

N75-28436# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIENCE GAINED IN THE USE OF Ni-RESIST INSERTS IN ENGINE CYLINDERS
M. A. Grigorev, N. N. Ponomarev, and E. I. Shanin 31 Dec. 1974 15 p refs Transl. into ENGLISH from Avtomob. Prom. (Moscow), no. 8, 1972 p 3-6
(AD-A005476; FSTC-HT-23-896-73) Avail: NTIS CSCL 21/7

Research has shown that during operation of a number of domestic engines a major portion of the wear is caused by abrasive particles which enter the engine by various routes: i.e. cylinder wear during operation is primarily abrasive in nature, not corrosive. Therefore, in order to determine the reasons for the enhanced wear resistance of Ni-resist inserts in comparison with grey cast iron, results of tests previously conducted were examined and analyzed, and some additional investigations were made. GRA

N75-28437# Woods Hole Oceanographic Institution, Mass.
ADVANCED MARINE TECHNOLOGY Technical Progress Report, 1 Feb. - 31 Jul. 1974
Earl E. Hays, David S. Hosom, Frederick R. Hess, Paul T. McElroy, William M. Marquet, Robert P. Porter, Robert C. Spindel, Foster L. Striffler, and Clifford L. Winget 15 Dec. 1974 27 p
(Contract N00014-71-C-0284; ARPA Order 293-008; NR Proj. 293-008)
(AD-A004940; WHOI-74-100) Avail: NTIS CSCL 13/10

A progress report is made for the period 1 February 1974 - 31 July 1974 on the following projects in Advanced Marine Technology: (a) Submerged Navigation. (b) Self Contained Ancillary Modular Platform. (c) Modular Acoustic System. (d) Wide Area Illumination. GRA

N75-28438# Woods Hole Oceanographic Institution, Mass.
ADVANCED MARINE TECHNOLOGY. HANDLING AND TRANSFER AT SEA SECTION Technical Progress Report, 1971 - 1974
Allyn C. Vine 13 Dec. 1974 39 p refs
(Contract N00014-71-C-0284; ARPA Order 293-0; NR Proj. 293-008)
(AD-A004941; WHOI-74-92) Avail: NTIS CSCL 13/10

Several installations and tests of special energy absorbing fenders on amphibious boats of from 4 to 300 tons, have given insight and design data on possible transfer of aircraft landing technology and concepts to boat handling to obtain safer and more reliable operations in rough seas. For reasons of design, cost and credibility surplus aircraft landing gear nose wheel assemblies mounted thwartships from the boats have formed the major starting point for these experiments. Any future optimum design might be much different as the requirements are different and perhaps less severe than for aircraft. GRA

N75-28439# TRW, Inc., Redondo Beach, Calif. Transportation and Environmental Operations.
SUSPENDED VEHICLE SYSTEMS (SVS). VOLUME 1: SYSTEM ENGINEERING STUDIES Final Report, Jul. 1972 - Jan. 1974
Stephen G. Meisenholder, Norman F. McGinnis, and Herbert R. Graham Apr. 1974 207 p refs
(Contract DOT-FR-30004)
(PB-240759/1; TRW-96034-L011-0-Vol-1; FRA-ORD/D-74-7-Vol-1) Avail: NTIS HC $7.25 CSCL 13B

This report discusses generic high speed ground transportation (HSGT) vehicles which are suspended from an overhead guideway. The performance and cost are predicted for trainable revenue vehicles which would use the overhead monorail principle and operate in the 150 to 250 mph speed regime. These vehicles and the necessary elevated guideway structure comprise the suspended vehicle system (SVS), which is an alternative to overriding HSGT systems, such as the tracked air cushion vehicle or high speed rail systems. The results of system studies are described in which the vehicle and guideway concepts are developed to satisfy the performance and safety requirements. GRA

N75-28440# TRW, Inc., Redondo Beach, Calif. Transportation and Environmental Operations.
SUSPENDED VEHICLE SYSTEMS (SVS). VOLUME 2: SUPPORTING ANALYSES FOR SYSTEM ENGINEERING STUDIES Final Report, Jul. 1972 - Jan. 1974
Stephen G. Meisenholder Apr. 1974 215 p refs
(Contract DOT-FR-30004)
(PB-240760/9; TRW-96034-L011-0-Vol-2; FRA-ORD/D-74-7A-Vol-2) Avail: NTIS HC $7.25 CSCL 13B

This report describes supporting analyses for the investigation of generic high speed ground transportation (HSGT) vehicles which

are suspended from an overhead guideway. Various problems are considered which apply to the design and operation of mass transportation vehicles which would use the overhead monorail principle for operation in the 150 to 250 mph speed regime. These vehicles and the necessary elevated guideway structure comprise the suspended vehicle system (SVS), which is an alternative to overriding HSGT systems, such as the tracked air cushion vehicle or high speed rail systems. The unique feature of the SVS is the vehicle pendulous suspension used to achieve large cabin bank angles (up to 25 degrees) in order to achieve high speeds on curved guideway alignments. GRA

N75-28441# Princeton Univ., N.J. Dept. of Civil and Geological Engineering.
THE MECHANICAL LIFT-OFF OF A COMPRESSED BEAM FROM A RIGID BASE
Yehia M. El-Aini Sep. 1974 23 p refs
(Grant DA-ARO(D)-31-124-73-G190)
(AD-A005202; RR-74-SM-5; ARO-11823-1-E) Avail: NTIS CSCL 20/11

Recently, the problem of mechanical buckling of a long beam resting on a frictionless rigid foundation and subjected to a uniform lateral loading was analyzed using a linear formulation. The purpose of this paper is to show that the linear analysis is not sufficient to predict a correct post-buckling response and that a completely non-linear formulation is needed. The problem is formulated as a variational problem with variable end points. The resulting non-linear boundary value problem is solved numerically using the Shooting Method. The non-linear solution indicates the presence of a lower buckling load, before which the only state of equilibrium is the undeformed state. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N75-28442 George Washington Univ., Washington, D.C.
STATISTICAL MODELS AND METHODS FOR MEASURING SOFTWARE RELIABILITY Ph.D. Thesis
Ernest H. Forman 1975 118 p
Avail: Univ. Microfilms Order No. 75-14331

The problem of assessing the reliability of computer software is examined. Analytical models are indentified for the reliability of large computer programs or systems of programs. The exact distribution and approximate bounds are obtained for the time to debug software for the basis software reliability model. The statistical properties of the parameter estimates are presented to propose a procedure of augmenting the sample times to failure with a censored statistic, and propose a stopping rule that signifies when the software has been completely debugged.
Dissert. Abstr.

N75-28443# Naval Postgraduate School, Monterey, Calif.
STOCHASTIC ORDERING IN RESIDUAL MIXING DISTRIBUTIONS
David R. Campbell Jul. 1974 14 p refs
(NR Proj. 042-300)
(AD-A005460; NPS-64-CM74071) Avail: NTIS CSCL 14/4

A mixture of failure rates can be present in an apparently homogeneous population of devices because of variability either in their manufacture or in the severity of their service environments. A mixing distribution is the probability distribution for different failure rates in such a population. A residual mixing distribution is the probability distribution for different failure rates in the population of surviving devices after a specified period of service or burn in. Residual mixing distributions resulting from arbitrary mixtures of constant failure rates are shown to be stochastically ordered (decreasingly) as the period of service or burn in is increased, and to approach in the limit a distribution degenerate at the smallest failure rate present in the production. GRA

N75-28444# National Bureau of Standards, Washington, D.C. Mechanics Div.
SHEAR AND TENSION-BENDING FATIGUE TEST METHODS FOR THREADED AIRFRAME FASTENERS Final Report
Daniel J. Chwirut, Donald E. Marlowe, and James S. Steel Sep. 1974 57 p refs
(COM-75-10417/4; NBSIR-74-465) Avail: NTIS HC $4.25 CSCL 13E

Fatigue test methods for threaded airframe fasteners loaded in other than direct tension are described. The types of loading considered are single shear, double shear, and tension-bending. The test fixtures used in these tests are described. Results of tests on fasteners from different manufacturers indicate that fasteners considered identical on the basis of direct tension procurement tests exhibit different fatigue life characteristics when loaded in shear and/or tension-bending. The test methods described may be of future value as procurement tests for airframe fasteners. GRA

N75-28445# Army Tropic Test Center, APO New York 09827.
DETERMINATION OF OPTIMUM TROPIC STORAGE AND EXPOSURE SITES. PHASE 2: PATTERNS AND PREDICTIONS OF TROPIC MATERIALS DETERIORATION Final Report, 1970 - 1973
W. H. Portig, J. C. Bryan, and D. A. Dobbins May 1974 67 p refs
(AD-A005018; USATIC-7405001) Avail: NTIS CSCL 11/6

A methodology investigation was made to determine time-decay curves describing the tropic material deterioration process and to develop a model for predicting deterioration from meteorological variables. The active portion of the project lasted from 1970-1973; and was performed in 16 sites that included coastal, forest, inland open, and shed exposure modes. Materials included steel, cotton, latex, butyl, polyvinyl chloride, and nylon. Samples were removed periodically and subjected to tensile tests. Meteorological measurements were also collected during exposure. Time decay curves with seasonably good fits were found in some cases but no generalized mathematical function was found applicable to all materials and all sites. In general, the linear model was superior, followed by double exponential and exponential. Recommendations included the adoption of experimental rather than correlational models in future studies; type of equations to use for specific material-mode combinations, and better definitions and measures of the tropic microenvironment. GRA

N75-28446# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
NONELECTRONIC RELIABILITY NOTEBOOK Final Report
William Yurkowsky, D. F. Cottrell (Martin Marietta Aerospace, Orlando, Fla.), T. R. Gagnier (Martin Marietta Aerospace, Orlando, Fla.), E. W. Kimball (Martin Marietta Aerospace, Orlando, Fla.), and T. E. Kirejczyk (Martin Marietta Aerospace, Orlando, Fla.) Jan. 1975 575 p refs Supersedes RADC-TR-69-458 Prepared in cooperation with Martin Marietta Aerospace, Orlando, Fla.
(Contracts F30602-69-C-0011; F30602-73-C-0135; AF Proj. 5519)
(AD-A005657; FR-70-16-7; RADC-TR-75-22; RADC-TR-69-458) Avail: NTIS CSCL 14/4

This study has as its major objective the collection, analysis, and presentation of the failure rate data and analysis methods that form the state-of-the-art of nonelectronic reliability. The Notebook is divided into a section containing the failure rate information and sections on specific analytical methods, namely, Applicable Statistical Methods Reliability Prediction, Demonstration and Specification. The analytical methods deemed to be useful for determining the reliability. GRA

N75-28447# Boeing Aerospace Co., Seattle, Wash.
DEVELOPMENTAL TESTS Final Report
Dec. 1974 79 p refs
(Contract DACA87-72-C-0002)
(AD-A005626; TM-101) Avail: NTIS CSCL 15/3

The memorandum summarizes the procedures and results of laboratory tests conducted on SAFEGUARD Tactical Support Equipment. Simulated EMP transient tests were conducted on 31 equipment items, mostly monitor and control devices. Measurements were made of damage/malfunction thresholds, instrument pickup, interport cross coupling and load impedance.

Tests were also performed to measure the effectiveness of electrical filters, surge suppressors and metal junction boxes as protective features. GRA

N75-28448# Army Tropic Test Center, APO New York 09827.
DETERMINATION OF OPTIMUM TROPIC STORAGE AND EXPOSURE SITES. REPORT 2: EMPIRICAL DATA Final Report, Feb. 1971 - Dec. 1973
J. F. Sprouse, M. D. Neptune, and J. C. Bryan Mar. 1974 101 p refs
(AD-A005017; USATTC-7403001) Avail: NTIS CSCL 11/6

A total of 238,850 microscope, photographic, tenstile strength, weight loss, reflectivity and transmissivity data points were collected during the course of this study. The investigation used nine experimental field test sites, seven established sites having past histories of use for tropic testing, and one air-conditioned control site for measuring site severity rates and patterns. The test sites existed throughout the Canal Zone on the Pacific coast, Atlantic coast and approximately at mid-Isthmus. Six basic materials representing three general material classes--textiles, metals and rubber--were used as indicators of site severity. These basic materials were cotton, polyvinyl chloride, nylon, latex rubber, butyl rubber and carbon steel. Materials were exposed at the tropic test sites for periods of 1 to 48 weeks during four seasonal exposure phases with tensile strength, corrosion weight loss, and microbial coverage used as experimental measurements of site severity. Results showed that individual tropic exposure sites do not provide uniform severity to all materials. The study provides tables of sites generally homogeneous in deterioration for steel, cotton, nylon, polyvinyl chloride and latex rubber. It also gives severity comparisons between experimental and established sites, Atlantic versus Pacific sites, and sites with different degrees of natural and man-made protection from the environment, such as lean-to shelters, the natural jungle canopy, open grasslands, coastal sites, and mangrove forest (swamp). GRA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance*.

N75-28449 British Library Lending Div., Boston Spa (England).
THERMAL STRESSES IN A FREE PLATE DURING A UNILATERAL PERIODIC HEATING-COOLING PROCESS
E. M. Goodfarb and B. B. Potapov [1974] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 8, 1974 p 129-132
(BLL-M-25059-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An examination was made of the stressed state in a free plate subjected to the unilateral action of a pulsating thermal flow. Expressions were obtained for determining the thermal stresses in time and space in the case of a periodic heating-cooling process. It is shown that during the turning point in the temperature curves, the stresses are greater than the stresses corresponding to the temperature distribution at the moment when the one type of thermal action changes over to the other. The results of an analysis of the thermally stressed state of a plate for the case, where the thermal flow penetration depth and full thickness of the plate are equal, are presented. Author

N75-28450 British Library Lending Div., Boston Spa (England).
HYDROSTATIC DEFORMATION OF ROUND DIAPHRAGM
V. N. Perotyatko and V. I. Bazaikin [1974] 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern. Met. (USSR), v. 8, 1974 p 70-74
(BLL-M-25057-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The equilibrium of a diaphragm at its yield point during unilateral loading by hydrostatic pressure was examined. The material in the diaphragm follows the Tresk-Sen-Venan yield condition which simplifies the solution and provides determination of a means of loading in a Tresk hexagon. The limiting pressure producing a plastic state in the membrane was established, and the stressed-deformed state corresponding to this pressure was determined. The possibility of existence of an annular zone with a(sigma sub r)-(sigma sub phi)=sigma sub 0 yield condition was investigated. Author

N75-28451 Utah Univ., Salt Lake City.
CALCULATION OF MOMENTS AND DEFLECTIONS IN A SIMPLY SUPPORTED RECTANGULAR PLATE WITH RANDOMLY SPACED INTERIOR COLUMN SUPPORTS Ph.D. Thesis
Bob Lynn Harris 1974 98 p
Avail: Univ. Microfilms Order No. 75-14438

The plate structure considered is a rectangular plate which has simple supports along its edges, randomly spaced interior column supports and a uniform load. This configuration is similar to a typical concrete slab floor of a multi-story building; the method of analysis presented could be a useful design aid for this type of structure. A working computer program was developed to find deflections and moments in the plate structure previously defined using the singular solution method. In order to establish the validity of the method, the results were computed to standard infinite series solutions and finite element solutions. The computer time and storage requirements of the singular solution and the infinite series solution were approximately the same, but the time and storage requirements of the finite element solution were greater. Dissert. Abstr.

N75-28452 City Univ. of New York.
THE ELASTIC BEHAVIOR OF A BALANCED FOUR-BAR LINKAGE WITH AN OVERHANGING ROCKER: THEORY AND EXPERIMENT Ph.D. Thesis
Walter Gottfried Jandrasits 1975 238 p
Avail: Univ. Microfilms Order No. 75-13637

The theoretical and experimental transverse vibrational behavior of the elastic rocker link of a four-bar linkage is presented. The rocker link contains a counterweight and its overhanging portion carries an endmass, while the crank and coupler links are assumed to be rigid. The partial differential equations of motion for the elastic link are derived by a systems' approach utilizing Hamilton's principle with auxiliary conditions. The solution for the deflections is based on the method of Kantorovich. The space portion of this solution consists of a prescribed set of shape functions, derived from the free vibration problem associated with the rocker link, which satisfy the geometric boundary conditions. The remaining time portion of the solution was obtained from nonhomogeneous Hill-type differential equations. The analysis of these Hill's equations furnishes stability criteria as well as the resonance conditions for the link. It is shown that for the particular shape function assumed, three modes of the solution form are necessary in order to sufficiently described the strain response of the link. Dissert. Abstr.

N75-28453 British Library Lending Div., Boston Spa (England).
STABILITY OF SIMPLY CONNECTED AND MULTIPLY CONNECTED RECTANGULAR PLATES UNDER ARBITRARY COMPRESSIVE LOAD
A. L. Livshits and V. L. Livshits Dec. 1974 14 p refs Transl. into ENGLISH from Izv. Akad. Nauk Arm. SSR, Ser. Mekh. (USSR), v. 24, no. 3, 1971 p 52-60
(BLL-RTS-8785) Avail: British Library Lending Div., Boston Spa., Engl.: 4 BLL photocopy coupons

A simple method, capable of being universally programmed, was proposed for calculating the stability of rectangular plates under the assumption of plan stress. The collocation method was suggested and was used to study simply and doubly connected plates. Author

N75-28454 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ARBITRARILY CURVED AND TWISTED SPACE BEAMS Ph.D. Thesis
William Francis Hunter 1975 114 p
Avail: Univ. Microfilms Order No. 75-15876

A derivation of the equations which govern the deformation of an arbitrarily curved and twisted space beam is presented. These equations differ from those of the classical theory in that extensional effects are included. Other departures from the

previous theory are that the strain - displacement relations are derived and that the expressions for the stress resultants are developed from the strain - displacement relations instead of assuming that the resultants are proportional to changes in the curvatures. It is shown that the torsional stress resultant obtained by the classical approach is basically incorrect except when the cross section is circular. Using a vector approach the exact expressions for the curvature components of a deformed space beam are developed. The governing equations are given in the form of twelve first-order differential equations. A numerical algorithm is given for obtaining the natural vibration characteristics and example problems are presented. Dissert. Abstr.

N75-28455 Virginia Polytechnic Inst. and State Univ., Blacksburg.
DELAYED YIELDING OF A PLANE STRESS VISCOELEASTIC DUGDALE MODEL Ph.D. Thesis
Arun DasGupta 1975 116 p
Avail: Univ. Microfilms Order No. 75-15871

The delayed yielding phenomena in a viscoelastic ductile polymer where crack growth is associated with the formation of a plastic zone at the crack tip, are characterized. Specifically, the delayed time after which catastrophic failure occurs almost instantaneously in front of the crack was dealt with. The bulk material is considered viscoelastic and is modelled by a modified Bingham model used by Brinson. The yielded material in the crazed region is modelled by the viscoplasticity model of Crochet. By applying Graham's extended correspondence principle and Crochet's theory to the Dugdale model a differential equation for time dependent yield stress in the plastic zone was obtained. The equation was solved for large as well as small load-to-yield-stress ratio by two fold differentiation. The final expression for yield stress was re-averaged in the plastic zone and plotted for various values of material parameters including the values for polycarbonate. Dissert. Abstr.

N75-28456 Missouri Univ., Columbia.
A STUDY OF PARAMETRIC INSTABILITY OF ECCENTRICALLY STIFFENED RECTANGULAR PLATES Ph.D. Thesis
Jeng Wen Chiou 1974 365 p
Avail: Univ. Microfilms Order No. 75-15976

The onset of parametric instability was investigated for a simply-supported rectangular stiffened plate subjected to periodic in-plane loads. The static buckling and the free vibration of the eccentrically stiffened plate were also studied as special cases of the parametric instability problem. Two different mathematical models, the discrete element model and the orthotropic model, were used to represent the stiffened plate. The Donnell-type nonlinear strain-displacement relations were employed in the derivation of the kinetic and potential energies of the system. The mass effects associated with rib and stringer eccentrically stiffened plates included the transverse inertia, the in-plane inertias, and the rotatory inertia of the stiffeners. For the cases studied, the greatest single effect on the location of the boundaries of the parametric instability was caused by the increase of the rigidity of either a rib or stringer to the point that the lowest value of critical buckling parameter corresponds with a spatial mode other than the first parametric spatial mode. Dissert. Abstr.

N75-28457 Washington Univ., St. Louis, Mo.
DESIGN OF CYLINDRICAL STEEL TANKS SUBJECTED TO CONCENTRATED SUPPORT LOADS Ph.D. Thesis
Shu-Chen Wang 1974 279 p
Avail: Univ. Microfilms Order No. 75-14939

The analytical method of thin shell theory was applied to the analysis of cylindrical steel tanks subjected to concentrated support loads. The method thus utilized becomes the finite segment method which is similar to the standard form of finite segment method. The exact solution within each element was utilized in the former case. As a special case of column supported tanks, the uniformly supported tanks are also analyzed based on the assumption that the column reactions are uniformly distributed around the support. For the discretely supported tanks, the method of Fourier expansion of higher harmonics was applied. In both uniformly and discretely supported tanks, the effects of geometric discontinuity as well as column reaction concentration were studied. Current design codes and standards for design of pressure vessels and steel tanks are reviewed with regard to structural details and allowable stresses, and design suggestions are presented. Dissert. Abstr.

N75-28458 Missouri Univ., Rolla.
STRUCTURAL BEHAVIOR OF COLD-FORMED STEEL MEMBERS MADE OF THICK SHEETS AND PLATES Ph.D. Thesis
Ai-Shen Liu 1974 297 p
Avail: Univ. Microfilms Order No. 75-15835

Analytical and experimental investigations were conducted with special emphasis on the effects of cold work on the mechanical properties of corners and the strength of bolted connections. Mathematical corner models for the prediction of tensile yield points of corners were studied in detail. Results show that the increase in yield point of corners is dependent upon the ratio of virgin ultimate tensile strength to virgin tensile yield point, the ratio of inside bend radius to the thickness of the corner, and the virgin tensile yield point. A regression analysis was used for the determination of tensile yield point of corners. Dissert. Abstr.

N75-28459 Louisiana Polytechnic Inst., Ruston.
OPTIMAL DESIGN OF A REINFORCED CONCRETE SLAB AND ITS COLUMN SUPPORTS Ph.D. Thesis
Abdul Karim Adib 1975 159 p
Avail: Univ. Microfilms Order No. 75-15093

A computerized optimal design of a reinforced concrete slab with no beams, supported on columns having neither drop panels nor capitals was developed. With the minimum weight of the structure being chosen as a criterion for optimality, formulas were derived to meet the requirements for strength, equilibrium, and serviceability. Limitations for deflection, shear, column action, and steel reinforcement provided most of the constraints. The equivalent frame method, combined with the slope-deflection approach, yielded the flexure limitations for six patterns of loadings. Expressions for stiffnesses, carry over factors, and fixed end moments for the slab-beam as well as the equivalent column were derived using the analogous column concept. The computer program was run with: (1) the clear span of the slab constrained in the long direction by a lower bound of one meter; (2) the clear span of the slab constrained in the long direction by a lower bound of four meters; and (3) the clear spans of the slab, both in the long and short directions, were constrained by a lower bound of four meters. Results of all runs are presented in tabular form. Dissert. Abstr.

N75-28460 Michigan Technological Univ., Houghton.
MODIFICATION AND SYNTHESIS OF LARGE DYNAMIC STRUCTURAL SYSTEMS Ph.D. Thesis
John Oscar Hallquist 1974 215 p
Avail: Univ. Microfilms Order No. 75-14397

A procedure is described based on eigenvalue modification and diakoptics for modifying and combining structural systems. The synthesis procedure utilizes the known eigenvalues and eigenvectors of the subsystems to calculate the solution of the combined system without having to solve the eigenvalue problem of the system explicitly. The interconnection was accomplished by constraining the displacements of adjacent nodal points of the subsystems or by coupling the subsystems elastically and inertially. The procedures are further generalized to permit the analysis of systems with nonproportional viscous damping and nonsymmetric matrices for which the algebraic and geometric multiplicities of the eigenvalues may differ. Numerical methods are discussed, and several example problems are solved. An illustrative FORTRAN computer code, undamped modification synthesis, is listed and may be used to interconnect and modify lumped mass subsystems in a stepwise manner with rigid and stiffness ties, and to make inertial modifications. Dissert. Abstr.

N75-28461 Illinois Univ., Urbana.
ON THE VIBRATION AND STABILITY OF FINITELY INFLATED SPHERICAL AND CYLINDRICAL ELASTIC MEMBRANES Ph.D. Thesis
Lien-Yan Chen 1975 73 p
Avail: Univ. Microfilms Order No. 75-14093

Two investigations on the behavior of inflated membranes composed of highly elastic material are included. The first deals

with the small vibrations of an inflated spherical membrane coupled with the motion of the gas internal and external to the membrane. Solutions appropriate for both symmetric and nonsymmetric modes of vibration were obtained. The second investigation examines the stability of a finitely inflated and extended cylindrical tube under overall axial compression. The critical load for tubes with closed-ends and with either simply-supported or fixed ends were determined. For a long tube the results are compared with the well-known Euler buckling load for struts in compression. An 'equivalent' Young's modulus of elasticites is derived, and it is shown that the critical load can be obtained from the Euler buckling formula by using the dimensions of the inflated state and the 'equivalent' Young's modulus. Dissert. Abstr.

N75-28462 North Carolina State Univ., Raleigh.
CLOSURE OF A GRIFFITH CRACK BY SYMMETRIC TIES Ph.D. Thesis
William Quinton Gurley 1973 76 p
Avail: Univ. Microfilms Order No. 75-15914

The problem of a Griffith crack in a thin plate, which is opened by uniform all-around tension at infinity, is considered. Two elastic ties of equal, finite lengths were attached to the plate by rivets idealized by rigid inclusions in the plate. The lines of action of the tie forces lie in the plane of the plate. The ties were positioned perpendicularly to the straight line crack and were symmetric with respect to the center of the crack. The effects of pre-load in the ties, the rigidity and length, spacing between the ties, etc., on stress intensity factors, crack surface displacements and the like were investigated. Especially significant was the determination of parameter relations that render an immobile equilibrium crack, which is, removal of the singularities in the stresses at the crack tips. Dissert. Abstr.

N75-28463 Michigan Technological Univ., Houghton.
ANALYSIS OF MULTI-AXIAL ANISOTROPIC CREEP, ROOF RESIN BOLTS, AND BED SEPARATION IN ROCK STRUCTURES USING THE FINITE ELEMENT METHOD Ph.D. Thesis
Sami Ahmed Kamal 1974 178 p
Avail: Univ. Microfilms Order No. 75-14399

The effect of material anisotropic creep behavior was studied in the case of transversely isotropic laminated rock. An analytical modeling technique for roof resin bolts in underground room and pillar systems is presented. For continuous rock, an iterative procedure was adopted to simulate the bolt effect on the rock structure by external nodal point loads, which were applied during the creep deformation stage. Bed separations represented by nonlinear joint elements were studied and the effect of having the beds bolted together was analyzed by modifying the characteristics of the joint elements that contained the bolts. Analytical techniques were applied to simple roof beam models of layered rock, and more complicated models of actual mine openings. The results show that the creep deflection of a homogeneous rock beam is relatively insignificant, but that the creep deflection of a nonhomogeneous beam of three different rock layers is significant. Dissert. Abstr.

N75-28464 Iowa Univ., Iowa City.
HIGHER ORDER ANALYSIS OF MODERATELY THICK CIRCULAR CYLINDRICAL SHELLS Ph.D. Thesis
Kunihito Matsui 1974 142 p
Avail: Univ. Microfilms Order No. 75-13790

A moderately thick circular cylindrical shell subjected to axisymmetric loading and thermal condition is studied. The governing equations are formulated in terms of the displacement functions by using the principle of a stationary value of total potential energy together with the assumption of small displacement theory. Linear elasticity, homogeneity, and isotropy are assumed. To reduce the two dimensional elasticity problem to a one dimensional problem, the displacement functions are expanded in a power series, with respect to the radial coordinate, and are truncated after the first four terms. The integration is carried out over the thickness of the shell. The effect of shear deformation and radial stress is included. It was found that the radial displacement is little affected by the radius-span and the thickness-radius ratios, and the hoop stress in a finite shell is approximately equal to that in an infinitely long shell under the same thermal conditions. To apply the numerical technique to time dependent problems, it was incorporated into the method of lines. The resulting scheme was compared with that of Crank-Nicolson for a simple diffusion equation and with the explicit finite difference method for a wave equation. Dissert. Abstr.

N75-28465 Maryland Univ., College Park.
ON THE THEORY OF EXTENDED FIELDS AND ITS APPLICATION TO THE PROBLEM OF FORCED VIBRATION OF THIN PLATES Ph.D. Thesis
Hani Mohamed Negm 1974 213 p
Avail: Univ. Microfilms Order No. 75-15780

The extended field method is an approximate method in the classical style that exactly satisfies the field equation, but only approximately satisfies the boundary conditions. As applied to the problem of the forced vibration of thin plates, the extended field method has force, displacement, and combined force-displacement versions. Finite Fourier sine series are used to describe the unknown displacement and force distributions, as well as the applied lateral pressures acting on the surface of the plate. The boundary condition approximation is improved by means of an error reduction technique in the manner of Galerkin. The extended field method is applied to triangular and trapezoidal plates with clamped or simple support boundary conditions, as well as rectangular plates with one free edge or two adjacent free edges. Numerical results of good quality were produced by the displacement version of the extended field method; a force version utilizing lines of forces produced faster converging but less stable results than those produced by the displacement version; and a combined force-displacement version produced results with better convergence stability than those of the force version. Dissert. Abstr.

N75-28466 North Carolina State Univ., Raleigh.
A NEW EXPERIMENTAL METHOD AND TECHNIQUE FOR DETERMINING DYNAMIC STRESSES DURING AXIAL WAVE PROPAGATION IN RODS Ph.D. Thesis
Robert Stuart Steele 1974 142 p
Avail: Univ. Microfilms Order No. 75-15166

A method and technique is described which was devised for using a manganin alloy gage to investigate the highly transient stress wave amplitudes of the type found propagating in axially impacted rods. The total response of the gage is divided into both a normal stress component and a plane strain component. Experiments are devised which determine the relationship between these strain values under which the total system is useful was determined. Using the new stress monitoring system, dynamic stress-strain curves are found for borosilicate and soda lime glasses, South African black granite, and 7075-T6 aluminum. Strain rates as large as -1500/sec and loading times on the order of 0.00001 seconds were used. The resulting dynamic elastic moduli are compared with quasi-static values and dynamic values determined at small strain rates for those materials. Dissert. Abstr.

N75-28467+ METRAVIB, Lyon (France).
DIMENSIONS OF DAMPED STRUCTURES USING VISCOELASTIC COATINGS Final Report [DIMENSIONNEMENT DES STRUCTURES AMORTIES PAR REVETEMENT VISCOELASTIQUE]
M. Poizat and P. Vialatoux Nov. 1973 30 p In FRENCH (Contract DGRST-72-7-0896)
Avail: NTIS HC $3.75

Theoretical and experimental investigations led to the determination of various criteria for dimensions of viscoelastic coating. This coating served as a function of dynamic characteristics and geometric and mechanic parameters. ESRO

N75-28468# Houston Univ., Tex. Dept. of Mechanical Engineering.
TRANSIENT RESPONSE OF RING-STIFFENED THIN CYLINDRICAL SHELLS WITH SYMMETRIC MASS LOADING
D. G. Probe (Lockheed Electronics Co., Houston, Tex.), C. D. Michalopoulos, and Douglas Muster 3 Jul. 1975 35 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Nov. 1975 Sponsored in part by Office of Naval Res.

Avail: NTIS HC $3.75

The transient response of simply supported, circular, cylindrical, thin -shell structures is considered. The effect of ring stiffeners and concentrated masses is analyzed in detail. Superposition of normal modes was used to compute the dynamic deflection and stress resultants for two transient surface loadings: an axial band of uniform pressure around the circumference and a plane pressure wave which passes the shell in a direction normal to its axis of symmetry. Numerical results are presented in graphical form for each surface loading for unstiffened and stiffened mass-loaded shells. Author

N75-28469# Wyoming Univ., Laramie. Dept. of Mechanical Engineering.

THERMODYNAMICS OF BRIDGES, ROADWAYS AND RUNWAYS Final Report

K. M. Pell, J. E. Nydahl, and V. A. Cundy Nov. 1974 100 p refs

(Contract DOT-OS-40017)

(PB-240675/9; UWME-DR-406/061; DOT-TST-75-41) Avail: NTIS HC $4.75 CSCL 13B

The basic methodology required provide accurate thermal simulations of highway structures is developed and documented. In order to verify the simulation, an experimental program to measure thermal response of two bridge decks and the adjacent roadway as well as the local micrometeorological parameters was undertaken. Data obtained indicate that (1) the asphalt overlaid deck surface is generally considerably warmer than either the concrete deck or the adjacent roadway, (2) the asphalt overlaid deck is subject to fewer freeze-thaw cycles than the concrete deck, and (3) the concrete deck surface is colder than the adjacent roadway surface. GRA

N75-28470# Engineering/Analysis Corp., Berkeley, Calif.

USER'S MANUAL FOR CEL/NONSAP, A NONLINEAR STRUCTURAL ANALYSIS PROGRAM

K. J. Bathe and F. E. Peterson Oct. 1974 150 p refs

(Contract N62399-73-C-0019)

(AD-A004988; E/AC-74-2; CEL-CR-75.004) Avail: NTIS CSCL 13/13

This user's manual documents the input data required for the computer program CEL/NONSAP. NONSAP is a nonlinear structural analysis program that predicts either static or dynamic response of structural analysis with material and/or geometric nonlinearities. The program can also be used to analyze linear problems. The following element options are contained in the program: truss, two-dimensional continuum, three-dimensional continuum and three-dimensional nodal tie elements. The three-dimensional nodal tie elements may be used to simulate structural dislocations and special conditions. GRA

N75-28471# Engineering/Analysis Corp., Berkeley, Calif.

THEORETICAL BASIS FOR CEL/NONSAP, A NONLINEAR STRUCTURAL ANALYSIS PROGRAM Final Report, May 1973 - Oct. 1974

K. J. Bathe and F. E. Peterson Oct. 1974 144 p refs

(Contract N62399-73-C-0019)

(AD-A004989; E/AC-74-3; CEL-75.005) Avail: NTIS CSCL 13/13

This program documents the theoretical basis for the computer program CEL/NONSAP. NONSAP is a nonlinear structural analysis program that predicts either static or dynamic response of structural systems with material and/or geometric nonlinearities. The finite element procedure is used for spatial discretization of the incremental equations of motion, and a step-by-step technique is used to compute the time dependent response. The algorithm used to solve the discrete set of nonlinear equations is a modified Newton iteration. Derivations of the finite element matrices are given for those elements currently operational in the NONSAP program element library. GRA

N75-28472# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

NATURAL FREQUENCIES OF VARIABLE THICKNESS BEAMS AND PLATES M.S. Thesis

Harry J. Geron Dec. 1974 48 p refs

(AD-A005282; GAE/MC/74-5) Avail: NTIS CSCL 20/11

Use of the perturbation method for approximating the fundamental frequencies and mode shapes of variable thickness, simply supported, square plates was expanded to include more specific problems such as higher order frequencies and mode shapes; the discretely stiffened beam and plate; and the simply supported, stepped plate. Perturbation theory is dependent upon representing the thickness of the plate as a continuous function with continuous first derivatives. This presents a problem in using the perturbation method for the discretely stiffened beam and plate, since the area of the stiffener is generally small in comparison to the overall area of the plate, and a reasonable approximation for the combined thickness is difficult to model mathematically as a continuous function. To satisfy these conditions a truncated Fourier series was used to approximate the thickness. GRA

N75-28473# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE USE OF EIGEN-DERIVATIVES TO PREDICT THE EFFECT OF DESIGN CHANGES UPON THE DYNAMIC CHARACTERISTICS OF STRUCTURAL ELEMENTS M.S. Thesis

James L. Vick Dec. 1974 87 p refs

(AD-A005281; GA/MC/74-6) Avail: NTIS CSCL 20/11

Equations relating the changes in the eigenvalues and eigenfunctions of a freely vibrating system due to changes in that system's physical configuration are derived from the integral formulation of the eigenvalue problem. These expressions are used to determine the natural frequencies and mode shapes of several non-uniform structural elements. The problems investigated include longitudinal motion of a stepped and linearly tapered bar, and the transverse motion of simply supported tapered and symmetrically shaped beams. The equations are used in conjuction with a first order Taylor series marching process to determine the change in system characteristics as the system's physical parameters change. For the systems investigated, this eigenderivative method produced good frequency and mode shape predictions for both the fundamental mode and the higher modes. GRA

N75-28474# Syracuse Univ., N.Y. Dept. of Mechanical and Aerospace Engineering.

STRESS AND STIFFNESS DATA FOR DISCRETELY ATTACHED CORRUGATED SHEAR WEBS WITH TRAPEZOIDAL CORRUGATIONS

M. Iqbal Hussain and Charles Libove Dec. 1974 135 p refs

(Grants NSF GK-35814; NSF ENG-72-04101)

(PB-240448/1; MAE-5170-T3) Avail: NTIS HC $5.75 CSCL 13M

Elastic analyses were made of trapezoidally corrugated plates in shear with four different kinds of discrete attachment between the ends of the corrugations and the framing members: (1) point attachments in the troughs, (2) point attachments in the troughs and at the crests, (3) wide attachments to a rigid flange, and (4) point attachments to a rigid flange. Numerical results are presented for the overall shearing stiffness and the maximum extreme-fiber transverse flexural strains which accompany the shearing of such plates. Numerical data are also presented for the tension in the attachment due to the prying action exerted of the rigid flange as it interferes with the deformation of the ends of the corrugations. GRA

N75-28475# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

THE INFLUENCE OF BOUNDARY CONDITIONS ON THE BUCKLING OF STIFFENED CYLINDRICAL SHELLS

Josef Singer and Aviv Rosen Jun. 1974 63 p refs Presented at the IUTAM Symp. on Buckling of Structures, Cambridge, Mass., 17-24 Jun. 1974

(Contract F44620-71-C-0116; Grant AF-AFOSR-2394-72)

(AD-A005697; TAE-213; AFOSR-75-0264TR) Avail: NTIS CSCL 20/11

Theoretical and experimental studies on the influence of boundary conditions on the buckling of stiffened cylindrical shells and their vibrations are discussed. The effect of prebuckling deformations on the buckling loads and vibrations of stiffened shells is studied and compared with that in the case of unstiffened shells. The in-plane boundary conditions are found to be of particular importance for stiffened cylindrical shells and their effect differs significantly from that in unstiffened shells. The effect of

axial restraints, which are found to be of prime importance in stringer-stiffened shells are also studied. GRA

42 GEOSCIENCES (GENERAL)

N75-28476 British Library Lending Div., Boston Spa (England).
BREATHING OF EARTH'S CRUST
[1974] 3 p Transl. into ENGLISH from Moskovskaya Pravda (USSR), 23 Apr. 1974 p 5
(BLL-M-23505-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A map is discussed which describes movements of the earth's crust in Eastern Europe. Vertical movements of the crust and geodetic observations are also discussed. M.J.S.

43 EARTH RESOURCES

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography*.

N75-28477 Pennsylvania Univ., Philadelphia.
ANALYSIS OF SCENES AS SEEN FROM THE EARTH'S SATELLITES Ph.D. Thesis
Mohamad Tavakoli 1974 246 p
Avail: Univ. Microfilms Order No. 75-14631

The use of pattern recognition methods in the recognition of agricultural areas and vegetation obtained from satellites pictures is presented. However, these methods neglect some very important spatial features such as spatial relationships or shapes and the fact that the recognition process is essentially an interpretation of two-dimensional pictures within the three-dimensional world. A recognition process, as a process of continuously refined descriptions of the hypothesized objects is described. Conceptual identifications of objects during the recognition process with meanings in the three-dimensional world are discussed. The representation of the environment with respect to the observer called the world model is also discussed. A successful recognition of computer scenes, such as the earth seen from a satellite, by using geometric properties in addition to spectral ones is shown. Dissert. Abstr.

N75-28478 Illinois Univ., Urbana.
SIMULTANEOUS ADJUSTMENT OF PHOTOGRAMMETRIC AND GEODETIC OBSERVATIONS Ph.D. Thesis
Gerald Mason Elphingstone 1975 164 p
Avail: Univ. Microfilms Order No. 75-14106

A general mathematical model was developed for analytical aerotriangulation, which can perform the simultaneous adjustment of photogrammetric and geodetic observations. The types of geodetic observations included in the mathematical solution are distances, geodetic azimuths, astronomical azimuths, horizontal angles, longitudes, latitudes, elevations and elevation differences. The solution can accept any configuration of geodetic surveys; such as traverse, triangulation, trilateration, leveling, as well as independent distances, azimuths, angles, and elevation differences. The types of photogrammetric observations include image coordinates, exterior orientation parameters, ground control points, and altimeter measurements. Primary emphasis on the analysis of the tests was placed on the effect of the geodetic observations on the photogrammetric mathematical model. This effect was analyzed for large and small photogrammetric blocks to determine the advantages and disadvantages of the combined solution. Dissert. Abstr.

N75-28479 Idaho Univ., Moscow.
DEVELOPMENT OF A DIGITAL GROUNDWATER MODEL WITH APPLICATION TO AQUIFERS IN IDAHO Ph.D. Thesis
Joseph Leonardus Johannes DeSonneville 1974 244 p
Avail: Univ. Microfilms Order No. 75-15475

A finite difference model is expanded to include iterative procedures to adjust the initial estimates of geohydrological parameters (transmissibility, leakance factor, head difference in leaky aquifer system and storage coefficient) to match historic aquifer behavior. The model includes a mass balance calculation routine, a routine to simulate open surface drains and a routine to calculate flow across hydraulically connected boundaries, such as a lake or stream. The parameter calibration routine as well as all other routines were tested and successfully applied to the gravel aquifer of the Snake River fan in eastern Idaho and the basalt aquifer of the Snake River plain in southern Idaho. The operational model successfully simulated the historic water table behavior in the aquifers and provides a reliable tool for studying effects of water management changes on aquifer behavior for research, planning or administrative purposes. Dissert. Abstr.

N75-28480 Wisconsin Univ., Madison.
APPLICATION OF REMOTE SENSING TO THE LOCATION OF HYDROLOGICALLY ACTIVE (SOURCE) AREAS Ph.D. Thesis
Achi Mohamed Ishaq 1974 241 p
Avail: Univ. Microfilms Order No. 75-9979

Surface and subsurface runoff, geographically concentrated at hydrologically active portions of a basin was studied. Two simultaneous processes which together produce storm runoff were considered: (1) a perennial channel system which expands and extends into zones of low storage capacity and directly intercepts precipitation which is rapidly incorporated into stream-flow. (2) The expanding channel system fed by subsurface flow, which enters at a slower rate than direct runoff, but may be responsible for the bulk of storm flow in some watersheds. Field studies were established at the water source areas determined from remote sensing analysis to investigate depth variation of soil moisture with time. Streamflow and precipitation monitoring sites were established. A method for identifying water source areas was established from the analysis of color infrared imagery. Results of statistical analysis of soil moisture and other data reveal that soil moisture in source areas is higher than in nonsource areas. Dissert. Abstr.

N75-28481 British Library Lending Div., Boston Spa (England).
CRAMBE ABYSSINICA
R. Ia. Kuznietsova [1974] 9 p Transl. into ENGLISH from Tr. Prikl. Bot. Genet. Selek. (USSR), v. 48, no. 3, 1972 p 240-245
(BLL-M-23445-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The agricultural and industrial utilization of the oilseed plant Crambe abyssinica is discussed. The chemical composition, physical characteristics, growth rate, and fruit yield of the plant are given. Growing conditions are discussed including type of soil, cultivation, and fertilization. J.M.S.

N75-28482*# Battelle Columbus Labs., Ohio.
CALIBRATION AND EVALUATION OF SKYLAB ALTIMETRY FOR GEODETIC DETERMINATION OF THE GEOID Progress Report, 1 Jun. - 30 Jun. 1975
A. George Mourad, Principal Investigator, S. Gopalapillai, M. Kuhner, and D. M. Fubara 14 Jul. 1975 27 p refs EREP (Contract NAS9-13276)
(E75-10344; NASA-CR-143146; PR-24) Avail: NTIS HC $3.75 CSCL 05B

The author has identified the following significant results. The Skylab altimeter experiment has proven the capability of the altimeter for measurement of sea surface topography. The geometric determination of the geoid/mean sea level from satellite altimetry is a new approach having significant applications in many disciplines including geodesy and oceanography. A generalized least squares collocation technique was developed for determination of the geoid from altimetry data. The technique solves for the altimetry geoid and determines one bias term for the combined effect of sea state, orbit, tides, geoid, and instrument error using sparse ground truth data. The influence of errors in orbit and a priori geoid values are discussed. Although the Skylab altimeter instrument accuracy is about plus or minus 1m, significant results were obtained in identification of large geoidal features such as over the Puerto Rico trench. Comparison

of the results of several passes shows that good agreement exists between the general slopes of the altimeter geoid and the ground truth, and that the altimerer appears to be capable of providing more details than are now available with best known geoids.

N75-28483*# Corps of Engineers, San Francisco, Calif.
[LANDSAT-2 IMAGERY FOR ENHANCING COASTAL PROCESSES] Progress Report, 1 Apr. - 31 May 1975
Douglas M. Pirie and David P. Steller, Principal Investigators (Calista Corp., Long Beach, Calif.) 2 Jun. 1975 2 p Sponsored by NASA ERTS
(E75-10345; NASA-CR-143147) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-28484*# New Mexico State Bureau of Mines and Mineral Resources, Socorro.
EARTH RESOURCES EVALUATION FOR NEW MEXICO BY LANDSAT-2 Progress Report, 27 Feb. - 31 May 1975
Karl VonderLinden, Principal Investigator, Sandra C. Feldman, Michael H. Inglis, David Tabet, and Frank E. Kottlowski 31 May 1975 5 p ERTS
(Contract NAS5-20916)
(E75-10346; NASA-CR-143148) Avail: NTIS HC $3.25 CSCL 08F

The author has identified the following significant results. A cost effective technique is considered for measuring and monitoring surface area fluctuations in lake size in southeastern New Mexico over a two year period. The lakes are shallow, and therefore a small volume increase results in a noticeable increase in surface area on the LANDSAT imagery. Lake sizes are measured on an I(2)S Digicol viewer. Water from potash mining operations is being pumped into some of these lakes and the input volume is documented. Using water input and surface contour as well as direct lake level measurements as ground truth as well as the LANDSAT images, calculations may be possible regarding how much additional industrial water can be added to these lakes without the occurrence of saline see page into the major river system.

N75-28485*# Earth Satellite Corp., Washington, D.C.
APPLICATION OF LANDSAT-2 DATA TO THE IMPLEMENTATION AND ENFORCEMENT OF THE PENNSYLVANIA SURFACE MINING CONSERVATION AND RECLAMATION ACT Progress Report, 19 Mar. - 19 Jun. 1975
Daniel J. Deely, Principal Investigator 19 Jun. 1975 6 p ERTS
(Contract NAS5-21998)
(E75-10347; NASA-CR-143149; C-1037-II-1) Avail: NTIS HC $3.25 CSCL 08I

There are no author-identified significant results in this report.

N75-28486*# Geological Survey, Reston, Va.
URBAN AND REGIONAL LAND USE ANALYSIS: CARETS AND CENSUS CITIES EXPERIMENT PACKAGE Monthly Progress Report
Robert Alexander, Principal Investigator, Harry F. Lins, Jr., and Daniel B. Gallagher 25 Feb. 1975 16 p EREP
(NASA Order T-5290-B)
(E75-10348; NASA-CR-143150) Avail: NTIS HC $3.25 CSCL 08B

The author has identified the following significant results. Temperatures in degrees Celsius were derived from PCM counts using the Pease's modified gray window technique. The Outcalt simulator was setup on the USGS computer. The input data to the model are basically meteorological and geographical in nature. The output data is presented in three matrices.

N75-28487*# Wyoming Univ., Laramie. Dept. of Geology.
SELENIUM IN SOILS OF THE LOWER WASATCH FORMATION, CAMPBELL COUNTY, WYOMING: GEOCHEMISTRY, DISTRIBUTION, AND ENVIRONMENTAL HAZARDS
Kenneth E. Kolm 6 Jun. 1975 114 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21799)
(E75-10349; NASA-CR-143151) Avail: NTIS HC $5.25 CSCL 08G

The author has identified the following significant results. Seleniferous Shingle series soils and sandstone outcrops of section 27, T 48 N, R 71 W, Wyoming are mapped on aerial photography by their association with Astragalus bisulcatus. Chemical leachate analyses and atomic absorption methods reveal all studied Samsil and Shingle soils to contain acid, base, and water soluble selenium compounds, and that water extractions showed varied concentration behavior due to soil pH. Acid-soluble selenium is found to be associated with smectite. Statistical analyses confirm that A. bisulcatus presence has a weak influence on soil-lens organic selenium concentration, and determine the importance of other geobotanical factors for convertor presence. Environmental procedures of high selenium lens burial, convertor plant eradication, and revegetated site monitoring are recommended. Usage of density analysis and photographic enlargement are used to successfully produce both a control area and a Campbell County, Wyoming regional map of A. bisulcatus supportive soils and outcrops using Skylab photography.

N75-28488*# Geological Survey, Reston, Va.
DRAINAGE BASIN CHARACTERISTICS FROM ERTS DATA Progress Report, 1 Jul. - 31 Dec. 1974
Este F. Hollyday, Principal Investigator 1 Jan. 1975 10 p ERTS
(NASA Order S-70243-AG)
(E75-10350; NASA-CR-143152) Avail: NTIS HC $3.25 CSCL 08H

The author has identified the following significant results. ERTS-derived measurements of forests, riparian vegetation, open water, and combined agricultural and urban land use were added to an available matrix of map-derived basin characteristics. The matrix of basin characteristics was correlated with 40 stream flow characteristics by multiple regression techniques. Fifteen out of the 40 equations were improved. If the technique can be transferred to other physiographic regions in the nation, the opportunity exists for a potential annual savings in operations of about $250,000.

N75-28489*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
AN ERTS-1 INVESTIGATION FOR LAKE ONTARIO AND ITS BASIN Final Report, 31 Jul. 1972 - 31 Jul. 1974
Fabian C. Polcyn, Allen Falconer, Principal Investigators, Thomas W. Wagner, and Diana L. Rebel Jul. 1975 96 p refs Original contains color illustrations. Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21783)
(E75-10351; NASA-CR-143153; ERIM-19330-65-F) Avail: NTIS HC $4.75 CSCL 08H

The author has identified the following significant results. Methods of manual, semi-automatic, and automatic (computer) data processing were evaluated, as were the requirements for spatial physiographic and limnological information. The coupling of specially processed ERTS data with simulation models of the watershed precipitation/runoff process provides potential for water resources management. Optimal and full use of the data requires a mix of data processing and analysis techniques, including single band editing, two band ratios, and multiband combinations. A combination of maximum likelihood ratio and near-IR/red band ratio processing was found to be particularly useful.

N75-28490*# Bureau of Mineral Resources, Geology and Geophysics, Canberra (Australia). Dept. of Minerals and Energy.
A MULTIDISCIPLINARY STUDY OF EARTH RESOURCES IMAGERY OF AUSTRALIA, ANTARCTICA AND PAPUA, NEW GUINEA Final Report
N. H. Fisher, Principal Investigator Mar. 1975 31 p Sponsored by NASA ERTS
(E75-10352; NASA-CR-143154) Avail: NTIS HC $3.75 CSCL 05B

The author has identified the following significant results. A

thirteen category recognition map was prepared, showing forest, water, grassland, and exposed rock types. Preliminary assessment of classification accuracies showed that water, forest, meadow, and Niobrara shale were the most accurately mapped classes. Unsatisfactory results, were obtained in an attempt to discrimate sparse forest cover over different substrates. As base elevation varied from 7,000 to 13,000 ft, with an atmospheric visibility of 48 km, no changes in water and forest recognition were observed. Granodiorite recognition accuracy decreased monotonically as base elevation increased, even though the training set location was at 10,000 ft elevation. For snow varying in base elevation from 9400 to 8420 ft, recognition decreases from 99% at the 9400 ft training set elevation to 88% at 8420 ft. Calculations of expected radiance at the ERTS sensor from snow reflectance measured at the site and from Turner model calculations of irradiance, transmission and path radiance, reveal that snow signals should not be clipped, assuming that calculations and ERTS calibration constants were correct.

N75-28491*# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
A STUDY OF ATMOSPHERIC EFFECTS ON PATTERN RECOGNITION DEVICES Final Report
Fred Thomson, Principal Investigator and F. G. Sadowski Jul. 1975 66 p refs Original contains color illustrations. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21783)
(E75-10353; NASA-CR-143155; ERIM-193300-62-F) Avail: NTIS HC $4.25 CSCL 08B

The author has identified the following significant results. ERTS-1 imagery can be applied in the broadscale assessment of forest resources as a supplement to aerial photography and field survey. There was no application to inventory of crop and pasture diseases mainly because of poor quality and low resolution, and unreliability of image acquisition. Inventory of soil erosion was satisfactory in humid eastern New South Wales, but not in semi-arid areas. Patterns of snow cover, areas of water in natural and artificial water bodies, extent of bushfires, and location of coastal mobile sand bodies were readily apparent. ERTS-1 imagery was judged to be a valuable addition to conventional techniques of regional small scale geological mapping. ERTS data was successfully used to map flooding and flood progression. The imagery was found suitable for mapping at 1:1,000,000 scale both on the mainland and in Antarctica, but did not meet accuracy specifications for 1:250,000 mapping.

N75-28492*# Texas A&M Univ., College Station. Remote Sensing Center.
MONITORING THE VERNAL ADVANCEMENT AND RETROGRADATION (GREEN WAVE EFFECT) OF NATURAL VEGETATION Final Report, Sep. 1972 - Nov. 1974
J. W. Rouse, Jr., Principal Investigator, R. H. Haas, D. W. Deering, J. A. Schell, and J. C. Harlan Nov. 1974 371 p refs Original contains imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21857)
(E75-10354; NASA-CR-143156; RSC-1978-4) Avail: NTIS HC $10.00 CSCL 08F

The author has identified the following significant results. The Great Plains Corridor rangeland project successfully utilized natural vegetation systems as phenological indicators of seasonal development and climatic effects upon regional growth conditions. An effective method was developed for quantitative measurement of vegetation conditions, including green biomass estimates, recorded in bands 5 and 6, corrected for sun angle, were used to compute a ratio parameter (TV16) which is shown to be highly correlated with green biomass and vegatation moisture content. Analyses results of ERTS-1 digital data and correlated ground data are summarized. Attention was given to analyzing weather influences and test site variables on vegetation condition measurements with ERTS-1 data.

N75-28493*# Environmental Research Inst. of Michigan, Ann Arbor. Information Systems and Analysis.
DEVELOPING PROCESSING TECHNIQUES FOR SKYLAB DATA Monthly Progress Report, Jun. 1975
Richard F. Nalepka, William A. Malila, Principal Investigators, and James P. Morgenstern 15 Jul. 1975 11 p refs EREP
(Contract NAS9-13280)
(E75-10355; NASA-CR-143157; ERIM-101900-59-L) Avail: NTIS HC $3.25 CSCL 05B

There are no author-identified significant results in this report.

N75-28494*# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF RECREATIONAL LAND AND OPEN SPACE USING SKYLAB IMAGERY Monthly Progress Report, Jun. 1975
Irvin J. Sattinger, Principal Investigator 14 Jul. 1975 2 p EREP
(Contract NAS9-13283)
(E75-10356; NASA-CR-143158; ERIM-103300-54-L) Avail: NTIS HC $3.25 CSCL 08B

There are no author-identified significant results in this report.

N75-28495*# National Environmental Satellite Service, Washington, D.C.
A CLOUD PHYSICS INVESTIGATION UTILIZING SKYLAB DATA Quarterly Progress Report, Apr. - Jun. 1975
John Alishouse, Herbert Jacobowitz, and David Wark, Principal Investigators Jun. 1975 3 p EREP
(NASA Order T-4715-B)
(E75-10357; NASA-CR-143159; QPR-9) Avail: NTIS HC $3.25 CSCL 04A

The author has identified the following significant results. The Lowtran 2 program, S191 spectral response, and solar spectrum were used to compute the expected absorption by 2.0 micron band for a variety of cloud pressure levels and solar zenith angles. Analysis of the three long wavelength data channels continued in which it was found necessary to impose a minimum radiance criterion. It was also found necessary to modify the computer program to permit the computation of mean values and standard deviations for selected subsets of data on a given tape. A technique for computing the integrated absorption in the A band was devised. The technique normalizes the relative maximum at approximately .78 micron to the solar irradiance curve and then adjusts the relative maximum at approximately .74 micron to fit the solar curve.

N75-28496*# Boeing Co., Kent, Wash.
QUANTITATIVE DETERMINATION OF STRATOSPHERIC AEROSOL CHARACTERISTICS Monthly Report, Jun. 1975
David L. Tingey, Principal Investigator Jun. 1975 14 p EREP
(Contract NAS9-13303)
(E75-10358; NASA-CR-143160) Avail: NTIS HC $3.25 CSCL 04A

The author has identified the following significant results. The multiplicative scale factor needed to calibrate the recorded intensity is obtained by fitting the measured curve against a brightness model. The model was converted to the multispectral band scanner signal. Inversion of this measured signature is shown as the profile of attenuation coefficients versus altitude. Because of Gaussian noise, data were not measured directly. Data were fit with two exponential curves, one covering the lower altitude and the other covering the higher altitude. A twenty point curve was derived by selecting a data point and plotting its value from each of twenty adjacent scans. Noise from the lower altitudes was found to be erratic.

N75-28497*# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
IN SITU SPECTRORADIOMETRIC QUANTIFICATION OF ERTS DATA Final Report, Jul. 1972 - Jan. 1975
Edward F. Yost, Principal Investigator Feb. 1975 169 p Original contains color illustrations. Original contains color imagery. Original photography may be purchased from the EROS Data Center, 10th and Dakota Avenue, Sioux Falls, S. D. 57198 ERTS
(Contract NAS5-21793)
(E75-10359; NASA-CR-143161; TR-21) Avail: NTIS HC $6.25 CSCL 05B

The author has identified the following significant results. Analyses of ERTS-1 photographic data were made to quantitatively relate ground reflectance measurements to photometric characteristics of the images. Digital image processing of photographic data resulted in a nomograph to correct for atmospheric effects over arid terrain. Optimum processing techniques to derive maximum geologic information from desert areas were established. Additive color techniques to provide quantitative measurements of surface water between different orbits were developed which were accepted as the standard flood mapping techniques using ERTS.

N75-28498*# National Marine Fisheries Service, Bay Saint Louis, Miss.
APPLICATION OF REMOTE SENSING FOR FISHERY RESOURCE ASSESSMENT AND MONITORING Progress Report, Jun. 1975
Kenneth J. Savastano, Principal Investigator 30 Jun. 1975 2 p EREP
(NASA Order T-8217-B)
(E75-10360; NASA-CR-143162; PR-18) Avail: NTIS HC $3.25 CSCL 08A

There are no author-identified significant results in this report.

N75-28499*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REMOTE MEASUREMENT OF TURBIDITY AND OTHER WATER QUALITY PARAMETERS
W. R. McCluney Jul. 1975 70 p refs
(NASA-TM-X-70933; X-913-75-153) Avail: NTIS HC $4.25 CSCL 13B

General approaches are used in the analysis of multispectral water color data collected by aircraft or satellite remote sensors. The theoretical modeling approach, in which optically important constituents of natural waters are mathematically related to the upwelling radiance spectrum received by the remote sensor, and the empirical approach, in which the relationships are determined empirically by comparing remote sensing data with surface truth data are discussed. It is shown that the approaches are closely related and should be pursued simultaneously for maximum utilization of the laboratory and field measurement data which will be needed. A set of minimum surface truth measurement parameters and techniques is suggested. Author

N75-28500*# Ecosystems International, Inc., Gambrills, Md.
IMPACT OF REMOTE SENSING UPON THE PLANNING, MANAGEMENT AND DEVELOPMENT OF WATER RESOURCES, APPENDIX Final Report, Jun. 1974 - Jun. 1975
Peter A. Castruccio, Harry L. Loats, Thomas R. Fowler, and Susan L. Frech Jun. 1975 85 p refs
(Contract NAS5-20567)
(NASA-CR-143822; ECO-75-C-3-3-App) Avail: NTIS HC $4.75 CSCL 08H

Lists are presented of water resource agencies from the Federal, state,Water Resources Research Institute, university, local, and private sectors. Information is provided on their water resource activities, computers, and models used. For basic doc., see N75-25263. Author

N75-28501*# Kansas Univ. Center for Research, Inc., Lawrence.
THE APPLICATION OF REMOTE SENSING TO RESOURCE MANAGEMENT AND ENVIRONMENTAL QUALITY PROGRAMS IN KANSAS Annual Report, 1 Apr. 1974 - 31 Mar. 1975
B. G. Barr Jul. 1975 96 p refs Original contains color illustrations
(Grant NGL-17-004-024)
(NASA-CR-143247) Avail: NTIS HC $4.75 CSCL 05B

Specific assistance to state agencies and public bodies on over 15 remote sensing projects concerned with (1) urban and regional analysis, (2) rural development, and (3) habitat management and environmental analysis is discussed. Specific problems of officials are considered and a basis for communication by demonstration is provided. In addition to data products in support of specific agency projects; consultation and training in use of satellite and aircraft imagery is provided to personnel from several state, regional, and county agencies. Effective communication and confidence is established through these efforts and users now routinely seek information and advice about the application of remote sensing technology to solution of their agency problems. Author

N75-28502*# Lockheed Electronics Co., Houston, Tex. Life Sciences Applications Dept.
INDEX MAPS FOR GEMINI EARTH PHOTOGRAPHY
L. E. Giddings Apr. 1975 97 p refs
(Contract NAS9-12200)
(NASA-CR-141934; LEC-4101; JSC-09581) Avail: NTIS HC $4.75 CSCL 08B

Index maps for the Gemini missions are presented; these are for the Gemini 3 through Gemini 12 missions. The maps are divided into four sections: the whole earth; the Western Hemisphere and eastern Pacific Ocean; Africa, India, and the Near East; and Asia, Australia, and the Pacific Ocean. M.J.S.

N75-28503# National Academy of Sciences - National Research Council, Washington, D.C.
NATIONAL MATERIALS POLICY
Jan. 1975 216 p refs Proc. of a Joint Meeting of the Natl. Acad. of Sci-Natl. Acad. of Eng., Washington, D. C., 25-26 Oct. 1973.
(Contracts NSF C-310; DI-BM-SO-133081)
(PB-240941/5; ISBN-0-309-02247-9) Avail: NTIS MF $2.25; HC Natl. Acad. of Sci., Washington, D. C. CSCL 05D

A broad range of issues and strategies dealing with national policy on materials to complement present energy and environmental programs is covered. Information on the size of materials reserves, more efficient recovery of nonrenewable resources, and the creative use of wastes and pollutants to extend the useful life of materials is discussed. Recommendations on further university and industry contributions to materials science and engineering, and on priorities for research and development are given. GRA

N75-28504# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
REMOTE SENSING OF ROCK TYPE IN THE VISIBLE AND NEAR-INFRARED
John W. Salisbury and Graham R. Hunt 27 Jan. 1975 9 p refs Presented at the Intern. Symp. on Remote Sensing of Environment (9th), Ann Arbor, 15-19 Apr. 1974
(AF Proj. 7670; AF Proj. 6813)
(AD-A005383; AFCRL-TR-75-0047) Avail: NTIS CSCL 08/7

Visible and near-infrared spectra of minerals and rocks have been measured and evaluated in terms of remote sensing applications. The authors conclude that there are some differences in the spectral behavior of different rock types in the visible and near-infrared. These differences are, however, difficult or impossible to use in a generalized remote sensing effort in which the composition of all rocks is to be mapped. Instead, this spectral region lends itself best to precise and particular applications, such as enhancing the visibility of a rock unit with a known and distinctive spectral signature, or enhancing the contrast between rock units, or between rocks and the vegetative background. GRA

N75-28505# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
APPLICATION OF REMOTE SENSORS TO ARMY FACILITY MANAGEMENT. APPENDIX B: VALIDATION OF ENVIRONMENTAL MAPS PRODUCED THROUGH AIR-PHOTO INTERPRETATION
John H. Shamburger and Harry K. Woods Jan. 1975 71 p
(DA Proj. 4A6-62707-A-890)
(AD-A005556; AEWES-TR-M-74-2) Avail: NTIS CSCL 15/5

A study was performed to validate environmental baseline factor maps of the Fort Belvoir study area, which were prepared through air-photo interpretation without the aid of any supplementary data. A field data collection program was conducted to provide data to be compared with the information derived from the analysis of the aerial photos. It was found that the air-photo interpretation was quite accurate, but that increased accuracy would result if ground truth data were available to the

interpreters during the interpretation process. For basic document, see N74-22621. GRA

N75-28506# Bureau of Mines, Denver, Colo. Mining Research Center.
FRACTAN: A COMPUTER CODE FOR ANALYSIS OF CLUSTERS DEFINED ON THE UNIT HEMISPHERE Information Circular
R. J. Shanley and M. A. Mahtab Feb. 1975 54 p refs
(PB-240685/8; BM-IC-8671) Avail: NTIS HC $4.25 CSCL 08I

A computer code is presented that was developed for isolating naturally occurring clusters of data plotted on the unit hemisphere and testing these clusters against a probability distribution which admits elliptical symmetry about its mean. A list of the computer code is provided along with an example output illustrating the delineation and analysis of clusters in fracture orientations measured in a porphyry copper deposit. GRA

N75-28507# California Univ., Berkeley. Inst. of Urban and Regional Development.
FEDERAL INVOLVEMENT IN THE CALIFORNIA COASTAL ZONE. A TOPICAL INDEX TO AGENCY RESPONSIBILITY
John K. Gamman, Shavaun Towers, and Jens Sorensen Nov. 1974 172 p
(Grant NOAA-2-35208)
(COM-75-10433/1; IMR-TR-42; Publ-29; NOAA-75031702) Avail: NTIS HC $6.25 CSCL 13B

The management of particular coastal resources, regulation of coastal use, and the assessment of potential environmental impacts for California's coastal zone are considered. Although the index is focused on California, it should be relevant to other coastal states. Organized according to topic headings, the directory identifies 82 Federal agencies with responsibilities that affect management of the coastal zone. GRA

N75-28508# Electric Power Research Inst., Palo Alto, Calif.
URANIUM RESOURCES TO MEET LONG TERM URANIUM REQUIREMENTS
Nov. 1974 123 p refs
(PB-239515/0; EPRI-SR-5) Avail: NTIS HC $5.25 CSCL 08G

Comparison between uranium requirements and uranium resources, the uncertainty concerning the size of the nation's uranium resources, and the future levels of uranium consumption are discussed. Published AEC uranium statistics form the basis for all of the quantitative uranium resources analysis. The United States is essentially unexplored for uranium and much more information is necessary to adequately assess the uranium potential of the country. GRA

N75-28509# Maryland Univ., College Park. Computer Science Center.
COMPUTER METHODS FOR CREATING PHOTOMOSIACS
David L. Milgram Jul. 1974 24 p refs
(Contract F44620-72-C-0062)
(AD-A005693; TR-313; AFOSR-75-0198TR) Avail: NTIS CSCL 08/2

A method is presented that makes it possible to put pictures together into photomosaics that have no visible seams between the pictures. GRA

N75-28510# Northwestern Univ., Evanston, Ill. Dept. of Geological Sciences.
COMPUTATION OF BICUBIC-SPLINE SURFACES FOR IRREGULARLY-SPACED DATA
E. H. Timothy Whitten and Maria E. V. Koelling Jan. 1975 63 p refs
(Grant DA-ARO(D)-31-124-G54)
(AD-A005169; TR-3; ARO-9894-11-EN) Avail: NTIS CSCL 08/2

Existing spline-surface programs require that the data be located at the nodes of a rectangular geographic grid. Algorithms are presented for one possible method of computing a spline surface for irregularly-spaced data points. The technique is illustrated for a small part of the subsurface Dundee Limestone, Central Michigan, U.S.A. A FORTRAN 4 Computer program (for CDC6400) and sample output are provided. GRA

N75-28511# Rome Air Development Center, Griffiss AFB, N.Y.
APPLICABILITY OF A TWO DIMENSIONAL, DIGITALLY INTEGRATING, SILICON VIDICON SYSTEM IN THE DETECTION OF NATURAL RESOURCES M.S. Thesis
Gregory B. Pavlin Jan. 1975 95 p refs
(AD-A005303; RADC-TR-74-209) Avail: NTIS

The feasibility of using a two-dimensional, digitally integrating, silicon vidicon system to differentiate terrestrial rock structure and mineralization was explored. The instrumentation was tested for its ability to: differentiate minerals; resolve detailed mineralized rock structure; enhance imagery of rock structure and/or mineralized features using computer software techniques; identify mineralogy without prior ground truth; distinguish altered from unaltered rock units associated with porphyry copper deposits; and perform as a practical geophysical tool in the field. It is concluded that the vidicon system using remote-sensing techniques is a potentially powerful geophysical tool. GRA

N75-28512# Little (Arthur D.), Inc., Cambridge, Mass.
RESEARCH ON WATER RESOURCES EVALUATION METHODOLOGY: A RIVER BASIN ECONOMIC AND FINANCIAL POST-AUDIT Final Report
John M. Wilkinson 31 Mar. 1975 203 p refs
(Contract DI-14-31-0001-4228)
(PB-241061/1; W75-06524; OWRT-C-5126(4228)(1)) Avail: NTIS HC $7.25 CSCL 13/3

This postaudit of the Pick-Sloan Missouri Basin Program attempted to quantify the 30-year performance of multipurpose programs in dollar terms. Applying current evaluation principles and standards of the Water Resources Council on an ex-post basis, the objective was to determine how much physical and dollar realities have differed from original plans, why they have differed, and what are the implications for future planning. It appears that flood control and electric power program performance far exceeded plan, while that for irrigation and navigation programs fell far short of plan. Benefits could be double or half most of those estimated in this post-audit, depending on value assumptions. GRA

N75-28513# Virginia Polytechnic Inst. and State Univ., Blacksburg. Div. of Minerals Engineering.
IMPACT OF HIGHER ECOLOGICAL COSTS ON SURFACE MINING Research Report, Jun. 1973 - Jun. 1974
W. E. Foreman Jun. 1974 172 p refs
(Grant DI-G-0133102)
(PB-240441/6; GM-OFR-12-75) Avail: NTIS MF $6.25 CSCL 08I

A mathematical model was developed to assess the costs for reclamation of surface mining using the shovel overcasting operation, the front end loader operation, and a backfilling operation. It was determined that the working mathematical model would have to be applied on an area to area basis, preferably on a permit by permit basis in the area where surface mining was being done. To this end, a flexible model was developed with input data obtained from the area of study. The results of the study show that the cost per ton of coal for reclamation can be estimated for various reclamation levels. Validation of the model was done for selected permits from Virginia. GRA

N75-28514# Bureau of Mines, Washington, D.C.
A SUMMARY OF SIGNIFICANT RESULTS IN MINING METALLURGY AND ENERGY, BUREAU OF MINES RESEARCH 1974
Mar. 1975 138 p
(PB-241084/2; BM-SP-1-75) Avail: NTIS MF $2.25; SOD HC CSCL 08I

Research projects in the minerals and fossil fuels fields are summarized. Topics covered include: technology to increase the percentage of recovery of oil, coal, natural gas, copper, and other mineral products; the economics of recycling scrap metals, efficient utilization of virgin metals and minerals by extending their mormal lifespan; and industrial uses for the wastes of mineral processing that costitute unsightly dumps and contribute to air, water, and land pollution. GRA

N75-28515# Bureau of Mines, Laramie, Wyo. Energy Research Center.
COMPOSITIONAL VARIATIONS OF ORGANIC MATERIAL FROM GREEN RIVER OIL SHALE-WOSCO EX-1 CORE (UTAH)
W. E. Robinson and G. L. Cook Mar. 1975 46 p refs
(PB-241244/3; BM-RI-8017) Avail: NTIS HC $3.75 CSCL 08D

The composition or chemical structure of the organic material in samples of Uinta Basin (Utah) oil shale were studied relative to stratigraphic position within the Green River Formation. This involved a systematic study of the soluble organic material and the insoluble organic material (Kerogen) present in the samples Emphasis was placed upon the distribution of the alkanes in the soluble extracts and upon the aromaticity of the kerogen. Significant differences exist in the chemical composition of the organic material from various strata within the Uinta Basin, some of which were related to burial depth but most were related to source material variations, or environmental differences. GRA

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells and batteries; global sources of energy; fossil fuels; geophysical conversion; hydroelectric power; and wind power.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *85 Urban Technology and Transportation.*

N75-28516 British Library Lending Div., Boston Spa (England).
SOVIET ENERGY POTENTIAL
M. Pervukhin [1974] 3 p Transl. into ENGLISH from Moskovskaya Pravda (Moscow), 21 Apr. 1974
(BLL-M-23413-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Various energy resources and their utilization in the U.S.S.R. are outlined. Coal, oil, gas, hydropower and atomic power are discussed. D.M.L.

N75-28517 AEG-Telefunken, Backnang (West Germany).
ANALYSIS OF TECHNOLOGICAL DEVELOPMENT PROBLEMS POSED BY USE OF ORBITAL SYSTEMS FOR ENERGY CONVERSION AND TRANSFER IN AND FROM SPACE Final Report [ANALYSE DER TECHNOLOGISCHEN ENTWICKLUNGSPROBLEME FUER DEN EINSATZ ORBITALER SYSTEME ZUR ENERGIEERZEUGUNG IM BZW. DER ENERGIEUEBERTRAGUNG AUS DEM WELTRAUM]
May 1975 502 p refs In GERMAN Prepared jointly with Dornier System and Tech. Univ. Berlin
(Contract RV-1/1-V-67/74-PZ-88-74)
Avail: Issuing Activity

Current American and European concepts of a solar satellite power station with associated technological problem areas was studied. Solar arrays, liquid gallium as a collecting contact, amplitrons and phased array earth antennas for microwave transmission and reception, respectively, and associated technological and theoretical implications, as well as typical spacecraft optimization problems are considered in detail. ESRO

N75-28518*# Little (Arthur D.), Inc., Cambridge, Mass.
FEASIBILITY STUDY OF SOLAR ENERGY UTILIZATION IN MODULAR INTEGRATED UTILITY SYSTEMS Final Report
30 Jun. 1975 187 p refs
(Contract NAS9-14524)
(NASA-CR-141929; ADL-78036) Avail: NTIS HC $7.00 CSCL 10A

The feasibility and benefits were evaluated of solar thermal energy systems on Integrated Utility Systems. The effort included the identification of potential system concepts, evaluation of hardware status, and performance of weighted system evaluations to select promising system concepts deserving of further study. Author

N75-28519*# National Aeronautics and Space Administration. Pasadena Office, Calif.
LOW COST SOLAR ENERGY COLLECTION SYSTEM Patent Application
Charles G. Miller (JPL) and James B. Stephens, inventors (to NASA) (JPL) Filed 24 Jul. 1975 57 p
(Contract NAS7-100)
(NASA-Case-NPO-13579-1; NASA-Case-NPO-13580-1; US-Patent-Appl-SN-598969) Avail: NTIS HC $4.25 CSCL 10A

A fixed, linear, ground-based primary reflector is described which has an extended curved-sawtooth contoured surface covered with a metallized polymeric reflecting material; It reflects solar energy to a movably supported collector that is kept at the concentrated line focus of the reflector primary. The primary flector was constructed by a process utilizing freeway paving machinery. The solar energy absorber is preferably a fluid-transporting pipe. Efficient utilization leading to high temperatures from the reflected solar energy was obtained by cylindrical shaped secondary reflectors that direct off-angle energy to the absorber pipe. Refocusing secondary reflectors which cause a series of discrete spots of highly concentrated solar energy to fall on the fluid-transporting pipe were used to obtain higher temperature levels. A seriatim arrangement of cylindrical secondary reflector stages and spot-forming reflector stages produces a high temperature solar energy collection system of greater efficiency. NASA

N75-28520 Solarex Corp., Rockville, Md.
DEVELOPMENT OF AN ECONOMICAL SILICON SOLAR CELL Quarterly Progress Report, 1 Jun. - 30 Sep. 1974
Joseph Lindmayer Oct. 1974 21 p
(Grant NSF GI-43091)
(PB-239281/9; NSF/RANN/SE/GI-43091/PR-74-3; NSF/RA/N-74-137; QPR-3) Avail: NTIS HC $3.25 CSCL 10B

The aim of this project is to investigate a method of growing electronically viable silicon films on inexpensive foreign substrates in order to reduce the overall cost of the silicon employed in photovoltaic solar energy conversion. The approach employed is to attempt enhancing the growth of large crystalline grains from a restricted nucleation area by confining arriving silicon atoms, to a narrow slit travelling across a substrate (the lateral growth technique). The initial efforts employ physical vapor deposition of silicon in a vacuum evaporator. GRA

N75-28521# Solarex Corp., Rockville, Md.
DEVELOPMENT OF 20 PER CENT EFFICIENT SOLAR CELL Quarterly Progress Report, 1 Jun. - 30 Sep. 1974
Joseph Lindmayer Oct. 1974 30 p
(Contract NSF GI-43090)
(PB-239280/1; NSF/RANN/SE/GI-43090/PR-74-3; NSF/RA/N-74-136; QPR-3) Avail: NTIS HC $3.75 CSCL 10B

The n-p cell was studied; the front junction formation was mapped using phosphorous and, in some cases, arsenic diffusion. As a result, good junction with high fill factors (sharpness of the junction) could be obtained in the temperature range 850-870 C. A large variety of materials were used on the back surface for the purpose of blocking rear diffusion and to determine their n-type or p-type character. The listing in the report is qualitative grouping, as each system represents a complex metalurgical. Physical-chemical system. Considering the fact that the index of refraction of silicon is relatively high, some optical coupling arrangement is required to reduce the attendant reflection. Preparation for solar electric experiments to be carried out in Antarctica is also discussed. GRA

N75-28522# Army War Coll., Carlisle Barracks, Pa.
TECHNOLOGICAL FEASIBILITY OF ALTERNATIVE ENERGY SOURCES
Maurice L. Zweigle 28 Oct. 1974 30 p refs
(AD-A005549) Avail: NTIS CSCL 05/3

The U.S. energy shortage is discussed. The technology of coal gasification or liquefication, shale oil from oil shale, and geothermal energy recovery is presented in sufficient detail to show feasibility of these as energy source alternatives to petroleum crude. Technical trade publications data show that essentially

all necessary process technology is known, although important improvements are possible, and have been proved at pilot plant scale. Conversion of coal to energy offers the best opportunity for rapid development as a broad, in-house U.S. energy source. The other two should be developed as time and funds are available. GRA

N75-28523# Worcester Polytechnic Inst., Mass. Dept. of Chemical Engineering.
SOLID WASTE CONVERSION: CELLULOSE LIQUEFACTION Final Report
James A. Kaufman and Alvin H. Weiss Feb. 1975 216 p refs
(Grant EPA-R-800688)
(PB-239509/3; EPA-670/2-75-031) Avail: NTIS HC $7.25 CSCL 07A

An extensive survey of the state-of-the-art in cellulose liquefaction and its chemistry, and the process concept is detailed and related to pyrolysis. Material with a heating value close to that of wood was used to make an oxygen, nitrogen, and sulfur free oil having a heating value in the vicinity of 10,000 cal/gm. Cellulose liquefaction process is a continuous hydrocracking process, based on technology which is readily available from the petroleum industry, although not previously applied to solid waste. The process envisioned uses a carrier oil in which the solid waste feed is slurried. The effects of catalyst, temperature, pressure and reaction time were correlated and catalyst optimized by simple batch and continuous experimentation. GRA

N75-28524# Stanford Univ., Calif.
WORKSHOP ON FUNDAMENTAL RESEARCH IN HOMOGENEOUS CATALYSIS AS RELATED TO US ENERGY PROBLEMS Final Report
James P. Collman, Jack Halpern, Jack Norton, and James Roth 6 Dec. 1974 43 p Workshop held at Stanford, Calif., 4-6 Dec. 1974
(Grant NSF MPS-04210)
(PB-240177/6) Avail: NTIS HC $3.75 CSCL 07D

Opportunities for the solution of energy problems by homogeneous catalysts were discussed along with recommendations for fundamental research that could accelerate these solutions. The following areas of research were recognized: (1) the homogeneous catalytic activation of saturated hydrocarbons; (2) selective oxidation of organic substances and the activation of oxygen; (3) the reduction of carbon monoxide, especially by hydrogen; (4) studies on multi-metal catalyst systems; (5) production of high energy substances; and (6) catalytic complexes involving unusual metal environments. GRA

N75-28525# Army Foreign Science and Technology Center, Charlottesville, Va.
COLD STORAGE BATTERY
N. S. Rudakov, Ye. I. Andreyev, and Yu K. Stalbo 20 May 1974 4 p refs Transl. into ENGLISH from the Russian patent no. 340856 (1972)
(AD-A005481; FSTC-HT-23-0342-74) Avail: NTIS CSCL 10/3

A cold storage battery is described which contains a cooling element inside a thermally insulated body. The elements are in the form of a perforate tank filled with hermetically sealed vessels containing a eutectic solution. The coolant passes over the vessels and the solution in them freezes. GRA

N75-28526# Bureau of Mines, Anchorage, Alaska. Field Operation Center.
IMPACT OF NATURAL GAS PIPELINE ON MINERAL AND ENERGY DEVELOPMENT IN ALASKA Open File Report
Robert G. Bottge 21 Mar. 1975 282 p refs
(PB-240638/7; BM-OFR-20-75) Avail: NTIS HC $8.75 CSCL 08I

The impact of one primary and seven alternative natural gas pipeline routes and their alternatives on Alaska's mining industry is discussed. Four routes begin on Alaska's North Slope and lead to the 48 contiguous States via Canada, while three routes lead to tidewater where it would be liquified for transport to West Coast ports. The geology and the potential for mineral and energy development by 1:250,000 quadrangles through which the various pipeline routes pass is summarized. The potential impact along each route is then discussed giving the type of development likely and the number of people who could be attracted to the area. GRA

N75-28527# National Center for Energy Management and Power, Philadelphia, Pa.
INTEGRATED SOLAR POWERED CLIMATE CONDITIONING SYSTEMS Semiannual Progress Report, 1 Jan. - 30 Jun. 1974
Jesse C. Denton Jul. 1974 67 p refs
(Grant NSF GI-29729)
(PB-239759/4; NSF/RANN/SE/GI-29729/PR-74-2; NSF/RA/N-74-152(4)) Avail: NTIS HC $4.25 CSCL 10B

Performance comparisons were made between direct solar heating, solar powered vapor compression and gas absorption heat pumps, electric resistance heating, and combustion furnace heating. Seasonal resource energy consumption for a Philadelphia single family residence was used as the measure of comparison. The attitudes of prospective purchasers toward using solar heating in their new homes were surveyed. Financial institutions were polled to determine whether they would grant additional loans on buildings equipped with solar heating systems in view of the expected operating cost savings. Government agencies were contacted to elicit plans for encouraging such loans. GRA

N75-28528# Mitre Corp., McLean, Va.
TRANSPORTATION ENERGY CONSERVATION: A PROGRAM PLAN OF POLICY-ORIENTED RESEARCH Final Report
Willard E. Fraize, Michael Lenard, and John Lieb Jan. 1975 77 p refs
(Contract FEA-C-04-50065-00)
(PB-240734/4; MTR-6843) Avail: NTIS HC $4.75 CSCL 10A

Transportation's role in energy conservation is reviewed. The Office of Transportation Research proposed research program to explore transportation energy use and alternative government policies related to transportation energy conservation is described. Project descriptions include estimated cost, suggested scheduling, priority designation, interrelationships with other projects and programs, and detailed task descriptions. GRA

N75-28529# Little (Arthur D.), Inc., Cambridge, Mass.
AN OVERVIEW OF ALTERNATIVE ENERGY SOURCES FOR LDCS
7 Aug. 1974 372 p refs
(Contract AID/TA/C-1089)
(PB-239465/8; ADL-C-77105) Avail: NTIS MF $10.00 CSCL 10A

An overview of alternative energy sources is presented which could be of significant value to lesser developed countries in adjusting to the impact of sharply higher world market prices of petroleum. It presents a highly condensed review of non-conventional energy technologies, together with some limited commentary on the relevance of the more conventional technologies in new lesser developed country economic settings. It also provides a summary on a country-by-country basis of the current economic posture and energy resources array. GRA

N75-28530# Industrial Research Inst., Inc., New York.
INSTITUTIONAL AND LEGAL CONSTRAINTS TO COOPERATIVE ENERGY RESEARCH AND DEVELOPMENT Final Report
Mar. 1975 174 p
(Contract DOC-4-35596)
(PB-240929/0; CTAB-75-2) Avail: NTIS HC $6.25 CSCL 10A

Guidelines are provided for the design and operation of research and development consortia with a minimum risk of antitrust challenge. A platform is given for a government-industry dialog on the need for and the barriers to cooperative research and development. The results of a survey of Industrial Research Institute member companies which identifies industry's perceptions of the barriers to cooperative research and development ventures and describes eight illustrative case histories is presented. GRA

N75-28531# Army Foreign Science and Technology Center, Charlottesville, Va.
WETTABILITY OF THE CASING AND ELECTROLYTE LEAKAGE IN AIRTIGHT NICKEL-CADMIUM STORAGE BATTERIES
R. V. Boldin 30 Sep. 1974 7 p refs Transl. into ENGLISH from Vses. Nauchn. Issled. Akkumuliatornyi Inst., Sb. Rabot po Khim. Istochnikam Toka (Leningrad), v. 7, 1972 p 161-163
(AD-A005065; FSTC-HT-23-1002-74) Avail: NTIS CSCL 10/3

The results of studying the wettability of 08KP steel used for manufacture of storage battery casings, with an alkali solution at various potentials of the metal's surface are presented. It is shown that greatest wettability, and consequently, an increased tendency toward electrolyte leakage along the storage battery casing is observed when the casing is connected electrically to the negative block of electrodes; smallest wettability is observed when the casing is insulated from the working electrodes. GRA

N75-28532# EIC, Inc., Newton, Mass.
LITHIUM-INORGANIC ELECTROLYTE BATTERIES Quarterly Report, 17 Sep. 1973 - 16 Sep. 1974
Gerhard L. Holleck, Michael J. Turchan, and David R. Cogley Jan. 1975 57 p refs
(Contract DAAB07-74-C-0030; DA Proj. 1T1-61102-A-3A)
(AD-A005057; C-401-4; ECOM-74-0030-4; QR-4) Avail: NTIS CSCL 10/3

An all-inorganic electrolyte, lithium primary battery operable over the temperature range -40 to +160F is being evaluated. The desired energy density is 150 watt-hours per pound of total battery weight and the desired power density is 50 watts per pound. At all temperatures, capacity is limited by polarization of the carbon electrode. Prolonged storage at 160F results in severe voltage delays and lower steady-state discharge voltages upon discharge at room temperature. Both the voltage delays and the lower discharge voltages are attributable to polarization of the Li electrode. Corrosion of Li in SOCl2 is more severe in practical stainless steel cells than in glass containers under high purity conditions. Reduction of SOCl2 on Ni, stainless steel, or C is a complex, potential dependent process. LiCl is a major constituent of electrode surface films formed upon reduction in SOCl2/LiAlCl4 solutions. GRA

N75-28533# Chrysler Corp., New Orleans, La. Space Div.
DEVELOPMENT OF AN AIRCRAFT BATTERY CONDITIONER/ANALYZER Final Report, 19 Jun. 1972 - 18 Dec. 1973
Dec. 1974 43 p
(Contract DAAJ02-72-C-0108; DA Proj. 1F1-62205-A-119)
(AD-A005055; USAAMRDL-TR-74-81) Avail: NTIS CSCL 10/3

The report documents the development and evaluation of a prototype Programmed Peak Charges (PPC) battery conditioner/analyzer system for nickel-cadmium batteries. It describes testing to determine the advantages of the unit as compared to constant-potential-charge systems. The results show that the PPC system reduces water boiloff, reduces overtemperature conditions, and has fewer battery recycles and cell replacements. Use of the PPC system increases battery life, reduces maintenance, and eliminates hazards. GRA

N75-28534# Energy Research Corp., Bethel, Conn.
LOW POWER METAL HYDRIDE FUEL CELL/BATTERY HYBRID SYSTEMS Final Report, 15 Jun. 1973 - 15 Oct. 1974
Bernard S. Baker and Ralph N. Camp Jan. 1975 50 p refs
(Contract DAAB07-73-C-0227; DA Proj. 1G7-63702-DG-10)
(AD-A005079; ECOM-0227-F) Avail: NTIS CSCL 10/3

The use of solid hydrides, solid super-oxides and hydrogen peroxide are examined as possible reactant sources for small fuel cell systems. Life testing of small calcium hydride-hydrogen peroxide powered alkaline matrix fuel cell is described. A complete six volt fuel cell subsystem was constructed using calcium hydride as fuel and hydrogen peroxide as oxidant. Water vapor produced by the fuel cell is used to react with the hydride to produce further hydrogen fuel. A Kipp Generator supplies oxygen from the catalytic decomposition of the hydrogen peroxide. The six volt output from the fuel cell is fed into a DC-DC converter where its output is boosted to 32V. The 32V is floated across 23 - 50mA hour nickel-cadmium batteries. The total system can deliver a steady 2mA at 32V or 430 mA-60ms pulses at 26V. GRA

N75-28535# Army Foreign Science and Technology Center, Charlottesville, Va.
SEMICONDUCTOR THERMOELECTRIC BATTERIES FOR AIR CONDITIONING
M. F. Byaleldinov, V. A. Efimov, B. S. Lupanov, and Yu. P. Khorunzhin 27 Nov. 1974 8 p Transl. into ENGLISH from Kholodiln. Tekh. (Moscow), no. 7, 1973 p 20-23
(AD-A005209; FSTC-HT-23-0165-75) Avail: NTIS CSCL 13/1

At the present there is a vast amount of semiconductor thermoelectric batteries in use in various combinations with respect to number and design configuration. They are the basis for manufacture of air conditioners, air coolers and thermostats. Depending on the design features, technical requirements and purpose of a device, a series of thermobatteries has been created of the type air-air which differ in their switching methods, radiator materials and construction. For the purpose of improving the technical and economic properties of thermobatteries, the technology for manufacture of Silumin cast radiators was developed. GRA

N75-28536# Wisconsin Univ., Madison. Inst. for Environmental Studies.
GLASS RECYCLING AND REUSE
Harold R. Samtur Mar. 1974 106 p refs
(Grant NSF GI-29731)
(PB-239674/5; IES-17; NSF/RA/E-74-015) Avail: NTIS HC $5.25 CSCL 13B

Methods are surveyed for recycling and/or reusing post-consumer glass products to determine which methods are most favorable. The following topics are included: the properties of glass, glass manufacture; analyses of alternatives to direct disposal of glass products; reuse of waste glass for glass manufacture; techniques for the separation of glass from municipal refuse; the development of degradable glass containers; returnable containers; and energy consumption for each of the major components of the glass cycle. GRA

N75-28537# Army Mobility Equipment Research and Development Center, Fort Belvoir, Va.
POWER SUPPLY TECHNOLOGY FOR ADVANCED WEAPON SYSTEMS Summary Report
W. D. Lee, J. H. Ferrick, J. T. Broach, C. J. Heise, and L. I. Amstutz Jul. 1974 46 p
(DA Proj. 1T1-62119-A-012)
(AD-A005013; USAMERDC-2107) Avail: NTIS CSCL 10/2

Certain weapon systems under consideration by the Army will require high power and/or high energy electrical inputs. Several technologies for power production are discussed with particular emphasis on military application. Rotating electrical machinery, fuel cells, and magnetohydrodynamic (MHD) power supplies are considered along with the supporting technologies of superconductivity, cryogenic refrigeration, and turbine engines. GRA

N75-28538# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMOELECTRIC DEVICES, BEING BLOWN THROUGH WITH A SUBSTANCE IN THE DIRECTION OF HEAT FLOW
G. K. Kotyrlo and G. M. Shchegolev 6 Apr. 1974 10 p refs Transl. into ENGLISH from Teplofiz. Teplotekh. Kiev, no. 19, 1971 p 132-135
(AD-A005205; FSTC-HT-23-1635-73) Avail: NTIS CSCL 10/2

Premeable thermoelements in thermoelectric devices. This type of battery can be used for utilizing heat of combustion products produced in a heat-using facility; the operating conditions of a premeable thermoelement were examined. Author

N75-28539# National Science Foundation, Washington, D.C. Div. of Advanced Energy Research and Technology.
PROCEEDINGS OF THE CONFERENCE ON ENERGY CONSERVATION IN COMMERCIAL, RESIDENTIAL AND

INDUSTRIAL BUILDINGS
7 May 1974 340 p refs Conf. held at Columbus, Ohio, 5-7 May 1974; Sponsored by Ohio State Univ., Am. Soc. of Heating, Refrigerating and Air-conditioning Engr., Inc., and the Assoc. of Phys. Plant Admin. of Univ. and Coll.
(PB-240306/1; NSF/RA/N-74-123) Avail: NTIS HC $9.50 CSCL 10A

Topics discussed are as follows: (1) Current energy conservation test projects, (2) energy conservation methods and associated problems in industry; (3) problems of energy conservation in existing buildings; (4) energy conservation methods in buildings; (5) computer programs and system simulations; (6) future changes in codes and buildings; and (7) possible research projects in energy conservation in the future GRA

N75-28540# Texas Instruments, Inc., Dallas. Semiconductor Group.
SOLAR SILICON DEFINITION Progress Report, 15 Oct. - 31 Dec. 1974
Gene F. Wakefield, Ting L. Chu, John W. Blair, George A. Brown, and Victor Harrap 20 Feb. 1975 50 p refs
(Grant NSF AER-75-03972)
(PB-240910/0; TI-03-75-15; NSF/RA/N-75-014) Avail: NTIS MF $3.75 CSCL 10B

The effects of selective impurities upon solar cell performance was investigated by preparation and characterization of a matrix of silicon samples. Evaluation of the 1-V curves to obtain the slope of the forward current of simple p-n junctions provided rapid material evaluation. Several iterations of matrix level redefinition, sample preparation, and reevaluation are required to establish maximum impurity tolerance. Experimental techniques have been demonstrated for achieving reliable data. Preliminary results indicate a substantially higher tolerance level than semiconductor silicon for most elements. GRA

N75-28541# Oregon Univ., Eugene.
EVALUATION OF THE PEPPLE SPRINGS NUCLEAR POWER PROJECT FOR NON-RENEWABLE RESOURCES
David L. Cole 26 Feb. 1975 24 p refs Prepared for Portland General Electric Co., Oreg.
(PB-240749/2; PGE-2008) Avail: NTIS HC $3.25 CSCL 05F

The report describes a study which evaluated the site of the Pebble Springs nuclear plant for historic, archaeological, and prehistoric resources in August, 1974. The study included a field survey, test excavations, and laboratory analysis. GRA

N75-28542# Northwestern Univ., Evanston, Ill.
THE IMMEDIATE IMPACT OF GASOLINE SHORTAGES ON URBAN TRAVEL BEHAVIOR Final Report
Robert L. Peskin, Joseph L. Schofer, and Peter R. Stopher Apr. 1975 150 p refs
(Contract DOT-FH-11-8500)
(PB-240866/4) Avail: NTIS MF $5.75 CSCL 13B

In response to the gasoline shortage of 1974, a small scale home interview survey was conducted in an attempt to identify and define: (1) changes in the price elasticity of demand for gasoline; (2) procedures for characterizing gasoline supply in travel behavior models; and (3) key implications for the development of transportation and urban design policies. The survey used a questionnaire design to measure changes in travel behavior, attitudes, and perceptions as a result of the increased price and decreased availability of gasoline. The study suggests that only an artificially constrained supply of gasoline, rather than modest increases in price, seem a promising control for consumption. GRA

N75-28543# Minnesota Univ., Minneapolis.
RESEARCH APPLIED TO SOLAR THERMAL SYSTEMS Semiannual Progress Report, 1 Jan. - 31 Jun. 1974
E. M. Sparrow, J. W. Ramsey, and G. K. Wehner Jul. 1974 189 p refs Prepared in Cooperation with Dynatherm Corp. and Honeywell, Inc., Minneapolis
(Grant NSF GI-34871)
(PB-241089/2; NSF/RANN/SE/GI-34871/PR-74-2; NSF/RA/N-74-147; SAPR-4) Avail: NTIS MF $7.00 CSCL 10B

Experiments of a scale model trough collector were performed at a desert test site. Absorbed solar energy was measured both for east/west and north/south orientations. The collector was found to absorb up to 61.5 percent of the available solar flux. Continuing life tests of candidate solar concentrator surfaces indicated that certain surfaces showed no degradation in reflectance. Solar absorber coating/substrate structures have been devised for high temperature operation and a technique developed for enhancing coating life expectancy in air. Cost characteristics of three transfer loop systems were determined and the most cost effective one was identified. GRA

N75-28544# Minnesota Univ., Minneapolis.
RESEARCH APPLIED TO SOLAR THERMAL POWER SYSTEMS Semiannual Report, 1 Jul. - 31 Dec. 1974
E. M. Sparrow, J. W. Ramsey, and G. K. Wehner Jan. 1975 112 p refs Prepared in cooperation with Dynatherm, Corp., Cockeysville, Md. and Honeywell, Inc., Minneapolis, Minn.
(Grant NSF GI-34871)
(PB-241090/0; NSF/RANN/SE/GI-34871/PR-74-4; NSF/RA/N-75-015; SAR-5) Avail: NTIS HC $5.25 CSCL 10B

Experiments were conducted on the scalemodel parabolic trough collector module at a desert test site. Collector performance was measured for absorber tube operation over a range of temperature from 210 to 300C. Auger electron spectroscopy studies of the diffusion phenomena in various solar absorber coatings were continued. An experimental model of a solar boiler/heat exchanger was designed. Measurements were made of the thermal conductivity of a candidate pipeline insulation. A computer program was written and applied for determining the heat transfer characteristics of phase-change heat storage media Preliminary data runs were made for a single-phase heat storage system. GRA

N75-28545# Delaware Univ., Newark. Inst. of Energy Conversion.
DIRECT SOLAR ENERGY CONVERSION FOR LARGE SCALE TERRESTIAL USE Annual Report, 1 Jan. - 31 Dec. 1974
K. W. Boer Jan. 1975 170 p refs
(Grant NSF GI-34872)
(PB-241007/4; NSF/RANN/SE/GI-34872/PR-74-4; NSF/RA/N-75-013) Avail: NTIS HC $6.25 CSCL 10B

Major aspects of the development of the Cu2S/CdS solar cell are presented. Results are reported in the following areas: (1) production of cells of conversion efficiency of 5% (2) Auger, Rutherford backscattering, and energy dispersive X-ray analysis; grain boundary and diffusion length studies; and Cu2S synthesis; (3) diode analysis, spectral response, solar simulation, response uniformity, and junction capacitance; (4) life tests; and (5) diode and light generated currents and the heterojunction model. GRA

N75-28546# Federal Power Commission, Washington, D.C. Office of Energy Systems.
MEASURE FOR REDUCING ENERGY CONSUMPTION FOR HOMEOWNERS AND RENTERS
25 Mar. 1975 24 p
(PB-240472/1) Avail: NTIS HC $3.25 CSCL 10A

A comprehensive set of measures is described that can lead to a large reduction in the quantity of fuel consumed by the typical residence. It is indicated that the savings given are not additive, since most energy conservation measures interact with one another. In addition, for the two most important areas of space heating and hot water heating, estimates of energy saved for the various options are given for different regions of the country. GRA

N75-28547# Gould, Inc., Oxnard, Calif. Stratham Instruments Div.
DEVELOPMENT OF AN ELECTRICAL ENERGY CONVERTOR FOR CIRCULATORY DEVICES Annual Report, 21 Jul. 1973 - 20 Jul. 1974
J. A. Chambets, J. G. Aldrich, Z. A. Davies, L. M. Mahler, and T. T. Yen Feb. 1974 106 p
(Contract NO1-HT-4-2906)
(PB-241044/7; NIH-NHLI-NO1-HT-4-2906-1) Avail: NTIS HC $5.25 CSCL 06B

A power system for the actuation of cardiac devices powered

by a brushless torque motor operating two triple lobed face cames is described. Digital and hybrid motor command computer circuits developed to produce faster response characteristics in the energy converter are discussed along with an implantable control battery module designed to provide ease of maintenance with O ring seals and plug in printed circuit boards. Design concepts and improved control logic was validated by tests performed with the convertor in a heart replacement blood pump. GRA

N75-28548# Bureau of Mines, Laramie, Wyo. Energy Research Center.
PRODUCING SNG BY HYDROGASIFYING IN SITU CRUDE SHALE OIL Report of Investigations, 1975
Lawrence K. Barker Feb. 1975 43 p refs
(PB-240841/7; BM-RI-8011) Avail: NTIS HC $3.75 CSCL 08I

The effect of temperature and pressure on the yield and composition of gas which could be obtained from an in situ crude shale oil is determined along with the effect extended operating times would have on gasification. Tests were also made to determine the temperature at which 90 volume-percent of the ethane was converted to methane and whether or not a cobalt-molybdate-on-alumina catalyst plays a significant part in conversion of light hydrocarbons. Both in situ crude shale oil and liquefied petroleum gas were used as feedstocks. Temperatures of 800 degrees to 1,400 degrees F, pressures of 500, 1,000, and 1,5000 psig, and operating times of 19 to 67 hours were used. A cobalt-molybdate-on-alumina catalyst was used for the catalyst experiments. GRA

N75-28549# Brown Univ., Providence, R.I. Dept. of Engineering.
INVESTIGATION OF THIN FILM SOLAR CELLS BASED ON Cu2S AND CERTAIN TERNARY COMPOUNDS Semiannual Progress Report, 1 Jun. - 31 Dec. 1974
Joseph J. Loferski Jan. 1975 66 p
(Grant NSF GI-38102)
(PB-241054/6; NSF/RA/N-75-016) Avail: NTIS HC $4.25 CSCL 10B

Thin films of the Cu-S system were prepared by sulfurizing thin films of copper on CdS single crystals, silica substrates, and on Si single crystals previously covered by a thin silicon oxide layer. The photovoltaic output of cells made by the chemical dipping process on single crystal CdS and CdS(1-x)Te(x) where = or < 0.01 were compared. Cathodoluminescence spectra were recorded for Cu2S samples of various types on an improved opto-electronic system. It was found that the Cu2S line is narrower than had been previously reported. Copper indium sulfide films were produced by sulfurizing sputtered CuIn films in H2S/H2 at 400C. GRA

N75-28550# Arizona Univ., Tucson. Optical Sciences Center.
CHEMICAL VAPOR DEPOSITION RESEARCH FOR FABRICATION OF SOLAR ENERGY CONVERTORS Annual Progress Report, 1 Jan. - 31 Dec. 1974
B. O. Seraphin 31 Jan. 1975 69 p
(Grant NSF GI-36731)
(PB-241006/6; NSF/RA/N-75-018) Avail: NTIS HC $4.25 CSCL 10B

Research on a new approach to a selective solar energy convertor that can be used to transform solar radiation into high temperature heat is discussed. The selective solar energy convertor is basically a two-layered construction in which the top layer is a semiconductor material, such as silicon, having high absorption for solar radiation and high transparency for blackbody radiation from the heated unit. The bottom layer is a metal film having high reflectance. This report describes the successful transfer of the previously developed technology to stainless steel substrates is described. GRA

N75-28551# American Bar Foundation, Chicago, Ill.
PROCEEDINGS OF A WORKSHOP ON SOLAR ENERGY AND THE LAW Interim Report
William A. Thomas 1975 34 p Conference held at Arlington, Va., 10 Feb. 1975
(Grant NSF APR74-21034)
(PB-241051/2; NSF/RA/S-75-004) Avail: NTIS HC $3.75 CSCL 10A

Topic areas discussed include: restrictions on building design and materials; access to sunlight; fiscal impediments and inducements; zoning; transferable development rights; and innovative land use laws. GRA

N75-28552# Little (Arthur D.), Inc., Cambridge, Mass.
THE BENEFITS/COSTS OF TERTIARY OIL RECOVERY Final Report
Dec. 1974 51 p
(Contract DI-BM-JO-155010)
(PB-240463/0; ADL-C-77591; BM-OFR-4-75) Avail: NTIS HC $4.25 CSCL 08I

The benefits of a secondary/tertiary research and development program were considered: (1) savings realized as a result of having cheaper supplementary oil available from tertiary recovery than would be otherwise available under uncertain alternative futures; (2) savings resulting from applying tertiary methods to stripper wells that would otherwise be closed and require more expensive reentry costs at a later time; (3) an alternative view of the benefits of tertiary recovery being equal to the full balance of payments value/barrel of recovered reserves, recovered at an earlier time; (4) value as emergency stockpile; and (5) insurance and portfolio values. GRA

45 ENVIRONMENT POLLUTION

Includes air, noise, thermal and water pollution; environment monitoring; and contamination control.

N75-28553 British Library Lending Div., Boston Spa (England).
SUB-SURFACE DISPOSAL OF WASTE: METHOD, LIMITATIONS, PROSPECTS
W. A. Visser [1974] 20 p Transl. into ENGLISH from De Ingenieur (Utrecht), v. 85, no. 41 p 800-810
(BLL-M-23428-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The drainage of fluid wastes in porous permeable rock strata by means of drilled wells, and the storage of solid or liquid (including radioactive) waste in mineral salt by means of leeching caves or dry tunnelling are discussed. The drainage and storage prospects exist in principle in the Netherlands and lie in geological formations in which the water of the hydrologic cycle is and remains isolated. Topics discussed include ground water, waste products, formation water, the geological composition of the subsurface, underground pressures, and safety analysis. M.J.S.

N75-28554 British Library Lending Div., Boston Spa (England).
COMBATING POLLUTION IN THE WORLD OCEAN
A. Yushohak and A. Simonov [1974] 5 p Transl. into ENGLISH from Pravda (USSR), 21 Mar. 1974 p 5
(BLL-M-23430-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

International cooperation in the regulation of harmful waste discharge in the sea and the protection of the sea waters is discussed. Emphasis is placed on the harmful effects of oil and oil products, mercury, detergents, and chloroganic pesticides in terms of water pollution and the overall production of the sea. J.M.S.

N75-28555 Utah State Univ., Logan.
DEVELOPMENT OF DYNAMIC PROGRAMMING MODEL FOR THE REGIONALIZATION AND STAGING OF WASTE-WATER TREATMENT PLANTS Ph.D. Thesis
Stanley Louis Klemetson 1975 198 p
Avail: Univ. Microfilms Order No. 75-14450

The general purpose of this research was to develop a mathematical computer model using dynamic programming to evaluate the timing and capacity expansion decisions for waste-water treatment facilities. The procedure consists of selecting the combination of treatment plants, trunk sewers, and treatment levels that best meet the desired objectives at the lowest future discounted cost. Among the factors affecting the regionalization and staging decisions are: (1) the quantity and quality of wastewater and its change with respect to time; (2) the rate of interest and the rate of inflation; (3) the capital,

operation and maintenance costs; (4) the treatment efficiencies; (5) the economies of scale; (6) the excess capacity; and (7) the service life. The model used a network notation to describe the treatment systems. The existing capacity, debt, elevation, and treatment level of the treatment plants, and the existing capacity, debt, and length of the proposed and existing trunk sewers were used to initialize the system. Dissert. Abstr.

N75-28556 California Univ., Davis.
LONG-TERM VARIATION OF PROCESS VARIABLES IN COMPLETE-MIX ACTIVATED SLUDGE Ph.D. Thesis
Jay William Nunley 1974 160 p
Avail: Univ. Microfilms Order No. 75-15447

Long term variation of process variables in complete mix activated sludge were studied using bench model reactors and respirometry with a peptone feed solution. The principal system was a CFSTR with recycle; it was operated at several cell retention times over a period of 11 months. The primary measurements included MLSS, effluent COD, bacterial plate counts, protozoan counts and respiration measurements. Activated sludge provided with feed of constant flow rate and constant strength did not attain a steady state in terms of any factor examined. It was found that the viable cell mass typically accounted for less than 15% of the total MLSS. Computation of cell retention time from sludge wastage rate alone was found to provide a sounder basis for maintenance of desirable sludge characteristics, including control of bulking sludge. Methods are proposed for controlling bacterial growth rates by hydrolyzing portions of the activated sludge to alter nutritional characteristics. Dissert. Abstr.

N75-28557 Illinois Univ., Urbana.
GAS CHROMATOGRAPHIC DETERMINATION OF INORGANIC OXYANIONS IN THE ENVIRONMENT Ph.D. Thesis
Barbara Ann Schreyer Stine 1975 115 p
Avail: Univ. Microfilms Order No. 75-14173

The expansion is described of the gas chromatographic technique to include normally nonvolatile inorganic oxyanions through the formation of volatile trimethylsilyl (TMS) derivatives. The species investigated are orthophosphate, polyphosphates, and sulfate. Several derivatization and analysis schemes are presented for orthophosphate which allow detection of as little as 50 picograms injected onto the gas chromatographic column (1 part per billion in aqueous solution). The method is applied to the determination of orthophosphate existing in aerosols in both marine and terrestrial atmospheres. Sampling programs are described and sample handling and treatment are discussed. The results indicate that terrestrial aerosols may contain as much as twice the amount of orthophosphate as marine aerosols in terms of background levels. The TMS derivatization process is also investigated for its possible utility in the determination of the sulfate ion in the atmosphere and in the determination of polyphosphates (i.e., pyrophosphate and tri-polyphosphate) in aqueous systems. Dissert. Abstr.

N75-28558 Wisconsin Univ., Madison.
STOCHASTIC MODELING FOR REAL-TIME WATER QUALITY CONTROL Ph.D. Thesis
Yoram J. Litwin 1974 271 p
Avail: Univ. Microfilms Order No. 75-9984

A methodology is presented for improving the use of telemetered water quality data for more effective water quality management. It comprises an extensive software system to enhance data utilization of information derived from continuously operating water quality monitoring networks. The Box-Jenkins AutoRegressive Integrated Moving Average parametric time series approach was utilized to develop parametric time series models of various water quality parameters for use in forecasting and forecast updating. Approximately 140 water quality parameters covering a variety of river conditions were analyzed. Control equations were developed which help specify needed management actions to ameliorate problems quickly. The applicability of the approach is demonstrated on the basis of telemetric water quality data obtained from the Lower Fox River in Wisconsin. The telemetry system recorded data at hourly intervals on dissolved oxygen, temperature, pH, conductivity and turbidity.
Dissert. Abstr.

N75-28559 Maryland Univ., College Park.
TRACE ELEMENT EMISSIONS OF COAL-FIRED POWER PLANTS: A STUDY OF THE CHALK POINT ELECTRIC GENERATING STATION Ph.D. Thesis
Ernest Scott Gladney 1974 372 p
Avail: Univ. Microfilms Order No. 75-15774

Samples of coal, bottom slag, economizer ash, fly ash and in-stack suspended particulates were collected inside the Chalk Point power plant. Filter and cascade-impactor samples of the ambient aerosol in the vicinity of the plant were also collected. These samples were analyzed by instrumental neutron activation analysis for about 30 elements and by instrumental photon activation analysis for about 7 elements in an effort to determine if coal-fired power plants are the source of a group of highly enriched trace elements observed on urban air particulates and the ambient aerosol. The power plant was found to increase particulate loading in the atmosphere around the plant. The elements Hg, As, Se, Sb, and Pb are strongly enriched on particulate emissions. However, data indicates that the plant does not act as a strong source for the highly enriched trace elements: Sb, As, Zn, Se, In, V, and Pb. Author

N75-28560*# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
MONITORING SPACECRAFT ATMOSPHERE CONTAMINANTS BY LASER ABSORPTION SPECTROSCOPY Semiannual Progress Report, Jan. - Jun. 1975
J. I. Steinfeld Jun. 1975 13 p
(Grant NGR-22-009-766)
(NASA-CR-143261) Avail: NTIS HC $3.25 CSCL 06K

Data were obtained which will provide a test of the accuracy of the differential absorption method for trace contaminant detection in many-component gas mixtures. The necessary accurate absorption coefficient determinations were carried out for several gases; acetonitrile, 1,2-dichloroethane, Freon-113, furan, methyl ethyl ketone, and t-butyl alcohol. The absorption coefficients are displayed graphically. An opto-acoustic method was tested for measuring absorbance, similar to the system described by Dewey. Author

N75-28561*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFLUENT SAMPLING OF TITAN 3 C VEHICLE EXHAUST
Gerald L. Gregory and Richard W. Storey, Jr. Washington Aug. 1975 27 p refs
(NASA-TM-X-3228; L-10120) Avail: NTIS HC $3.75 CSCL 13B

Downwind in situ ground-level measurements of the exhaust from a Titan 3 C launch vehicle were made during a normal launch. The measurement activity was conducted as part of an overall program to obtain field data for comparison with the multilayer dispersion model currently being used to predict the behavior of rocket vehicle exhaust clouds. All measurements were confined to land, ranging from the launch pad to approximately 2 kilometers downwind from the pad. Measurement systems included detectors for hydrogen chloride (HCl), carbon dioxide (CO2), and particulates (Al2O3). Airborne and ground-based optical systems were employed to monitor exhaust cloud rise, growth, and movement. These measurement systems, located along the ground track (45 deg azimuth from the launch pad) of the exhaust cloud, showed no effluents attributable to the launch. Some hydrogen chloride and aluminum oxide were detected in the surface wind direction (15 deg azimuth) from the pad. Comparisons with the model were made in three areas: (1) assumption of cloud geometry at stabilization; (2) prediction of cloud stabilization altitude; and (3) prediction of the path of cloud travel. In addition, the importance of elemental analyses of the particulate samples is illustrated. Author

N75-28562*# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Science.
OUR CONTAMINATED ATMOSPHERE: THE DANGER OF CLIMATE CHANGE, PHASES 1 AND 2 Final Report
Alan J. Cimorelli and Frederick B. House [1974] 76 p refs
(Contract NAS1-11871)
(NASA-CR-132625) Avail: NTIS HC $4.75 CSCL 13B

The effects of increased concentrations of atmospheric particulate matter on average surface temperature and on the

components of the earth's radiation budget are studied. An atmospheric model which couples particulate loading to surface temperature and to changes in the earth's radiation budget was used. A determination of the feasibility of using satellites to monitor the effect of increased atmospheric particulate concentrations is performed. It was found that: (1) a change in man-made particulate loading of a factor of 4 is sufficient to initiate an ice age; (2) variations in the global and hemispheric weighted averages of surface temperature, reflected radiant fluz and emitted radiant flux are nonlinear functions of particulate loading; and (3) a black satellite sphere meets the requirement of night time measurement sensitivity, but not the required day time sensitivity. A nonblack, spherical radiometer whose external optical properties are sensitive to either the reflected radiant flux or the emitted radiant flux meets the observational sensitivity requirements.
Author

N75-28563# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
PHASE EQUILIBRIUM AND FLOW-INDUCED DESORPTION DATA FOR He-CO, He-N2O, AND He-N2 SYSTEMS Final Report
W. G. Steward, R. O. Voth, J. Hord, W. R. Parrish, and C. F. Sindt Mar. 1975 63 p refs
(COM-75-10368/9; NBSIR-75-806) Avail: NTIS HC $4.25 CSCL 07D

Liquid vapor equilibrium data were obtained for the helium carbon monoxide and helium nitrous oxide systems at pressures to 138 bars. Internal consistency of the data was checked by using pseudo Henry's law constants and enhancement factors. The effects on flow of helium absorption and subsequent flow induced desorption were investigated by means of reduced scale model experiments. Friction losses attributable to helium desorption in the long channels proved to be negligible. The assumption of phase equilibrium leads to gross miscalculations of flow rates in cavitating or near cavitating nozzles or venturis. Pertinent experiences in handling these fluids and operating the test equipment are also discussed. GRA

N75-28564# National Environmental Research Center, Research Triangle Park, N.C.
ENVIRONMENTAL EXPOSURE SYSTEM FOR STUDYING AIR POLLUTION DAMAGE TO MATERIALS Final Report
John W. Spence, Fred D. Stump, Fred H. Haynie, and James B. Upham Jan. 1975 46 p refs
(PB-240615/5; EPA-650/3-75-001) Avail: NTIS HC $3.75 CSCL 13B

Design features of a controlled environment exposure system consisting of five chambers are described. The purpose of the environmental system is to provide simulated environments for conducting statistical experiments for determining pollutant damage to materials. Design features include independent controls for regulating temperature, relative humidity, and concentration of gaseous sulfur dioxide, nitrogen dioxide, and ozone. The system also includes a variable dew/light cycle that incorporates chill racks to produce dew and xenon lamps to simulate sunlight. Before initiating exposure studies, differences in lighting and pollutant distribution among the chambers were minimized to below 10 percent variations for 95 percent of the measurements. GRA

N75-28565# NATO Committee on the Challenges of Modern Society, Brussels (Belgium).
AIR POLLUTION: AIR QUALITY CRITERIA FOR PHOTOCHEMICAL OXIDENTS AND RELATED HYDROCARBONS
Feb. 1974 452 p refs
(PB-240579/3; NATO/CCMS-29) Avail: NTIS HC $11.50 CSCL 13B

Contents: Hydrocarbons and other intermediates in the production of oxidants in ambient air; atmospheric concentrations; measurement methods; effects on vegetation; effects of ozone on materials; toxicologic effects; epidemiological appraisal of photochemical oxidants. GRA

N75-28566# Southwest Research Inst., San Antonio, Tex.
COLLABORATIVE STUDY OF METHOD FOR THE DETERMINATION OF SULFURIC ACID MIST AND SULFUR DIOXIDE EMISSIONS FROM STATIONARY SOURCES Environmental Monitoring Series
Henry F. Hamil, Richard E. Thomas, and David E. Camann Nov. 1974 58 p refs
(Contract EPA-68-02-0626)
(PB-240752/6; EPA-650/4-75-003) Avail: NTIS CSCL 07D

Statistical analyses are performed on data obtained in collaborative testing of EPA method for determination of sulfuric acid mist and sulfur dioxide emissions from stationary sources and from ancillary tests performed in conjunction with the analysis of the field samples. A collaborative test was conducted using four laboratory teams at a sulfuric acid plant. There was a tendency in these data for occasional high reported concentrations of sulfuric acid mist. On these samples, there was noticed a concurrent tendency for low reported sulfur dioxide concentrations. Since it cannot be determined that this phenomenon is unrelated to the method, these values are included in the data set to obtain the precision estimates. GRA

N75-28567# NUS Corp., Rockville, Md.
MINE DRAINAGE POLLUTION CONTROL DEMONSTRATION GRANT PROCEDURES AND REQUIREMENTS
Frank J. Zaval and Robert A. Burns Oct. 1974 110 p
(Contract EPA-68-03-0268)
(PB-240692/4; EPA-670/2-74-003) Avail: NTIS HC $5.25 CSCL 13B

Procedures and requirements are presented for use by all individuals considering or participating in grant demonstration projects authorized by Federal Water Pollution Control Act Amendments of 1972. GRA

N75-28568# National Environmental Research Center, Research Triangle Park, N.C.
METHODOLOGY FOR ASSIGNMENT OF A HYDROCARBON PHOTOCHEMICAL REACTIVITY INDEX FOR EMISSIONS FROM MOBILE SOURCES Environmental Protection Technology Series
Francis M. Black, Larry E. High, and John E. Sigsby Mar. 1975 28 p refs
(PB-240721/1; EPA-650/2-75-025) Avail: NTIS HC $3.75 CSCL 07D

An analytical scheme is presented which permits assessment of the photochemical significance of light-duty mobile source hydrocarbon emissions. The scheme incorportates both the mass and atmospheric reactivity of the hydrocarbon emissions. Analytical procedures supplementary to those defined for light-duty mobile source certification in the Federal Register are defined. Gas chromatographic analysis hydrocarbons is described. GRA

N75-28569# Bureau of Mines, Tuscaloosa, Ala. Metallurgy Research Lab.
THE FLORIDA PHOSPHATE SLIMES PROBLEM: A REVIEW AND A BIBLIOGRAPHY Information Circular, 1972 - 1974
Jan. 1975 46 p refs
(PB-240686/6; BM-IC-8668) Avail: NTIS; SOD HC as 128.27:8668 CSCL 08I

The disposal of phosphatic clay wastes (slimes) which involves above ground storage behind earthen dams is considered an environmental hazard. Various aspects of the slimes problem are discussed along with past research. A bibliography of references and patents dealing with the subject is presented. GRA

N75-28570# Booz-Allen and Hamilton, Inc., Bethesda, Md.
GUIDELINES FOR AIR QUALITY MAINTENANCE PLANNING AND ANALYSIS. VOLUME 7: PROJECTING COUNTY EMISSIONS. SECOND EDITION
Jan. 1975 190 p refs
(Contract EPA-68-02-1005)
(PB-240659/3; EPA-450/4-77-008-Vol-7; OAQPS-1.2-026; APTIC-75069) Avail: NTIS HC $7.00 CSCL 13A

A specific and uniform methodology is defined to upgrade existing emission inventories and to forecast future emissions of air pollutants within small geographical areas. The techniques presented are designed to be used by State and local air pollution control personnel in compiling baseline data for the State plans to maintain National Ambient Air Quality Standards. GRA

N75-28571# VTN Consolidated, Inc., Irvine, Calif.
THE NATIONAL ENVIRONMENTAL POLICY ACT PROCESS STUDY: AN EVALUATION OF THE IMPLEMENTATION AND ADMINISTRATION OF THE NEPA BY THE FOREST SERVICE AND THE BUREAU OF LAND MANAGEMENT Final Report
Feb. 1975 262 p
(Contract EQC-324)
(PB-239672/9) Avail: NTIS HC $8.50 CSCL 13B

Significant differences between the Forest Service and the Bureau of Land Management existed in their approach to and preparation of environmental impact statements even though their land and resource management functions were basically similar in terms of the decisions being made. It appeared that a major methodological disparity existed in the agencies statement processes. Their land use planning and environmental analysis systems were evaluated and the findings validated using case studies of selected resource development activities to determine the stages at which environmental issues were included and to track the decision making process. GRA

N75-28572# Triangle Universities Consortium on Air Pollution, Chapel Hill, N.C.
PROCEEDINGS OF THE SYMPOSIUM ON STATISTICAL ASPECTS OF AIR QUALITY DATA Environmental Monitoring Series
Lawrence D. Kornreich Oct. 1974 258 p refs Conference held at Chapel Hill, N. C., 9-10 Nov. 1972
(Contract EPA-68-02-0994)
(PB-240214/7; EPA-650/4-74-038; APTIC-75067) Avail: NTIS; SOD HC CSCL 13B

The 15 papers in these proceedings analyze air quality data as a function of frequency, maxima, the form of the frequency distribution, and averaging time. Concentrations and frequency distributions calculated with meteorologic diffusion models are compared with observed values. Discussions that followed the paper presentations are included. GRA

N75-28573# Environmental Law Inst., Washington, D.C.
USED OIL LAW IN THE UNITED STATES AND EUROPE Socioeconomic Environmental Studies Series
William A. Irwin and Richard A. Liroff Jul. 1974 305 p refs
(Contract EPA-68-01-2203)
(PB-239449/2; EPA-600/5-74-025) Avail: NTIS; SOD HC $6.15 as EP1.23/3:600/5-74-25 CSCL 13B

Existing information on the collection and disposal of used automotive and industrial oils and on the potential health risks of improper disposal of such oils, is reviewed. Provisions of federal law governing disposal of used oils are analyzed. The history of federal taxation of lubricating oils is recounted, as is that of federal requirements for labeling products made from used oils. State laws regulating used oil disposal and reprocessed oil labeling are analyzed and the laws of several other industrialized nations governing used oil collection and disposal are described. The elements of a comprehensive program for regulating used oil collection and disposal. GRA

N75-28574# Environment Control Corp., Painesville, Ohio.
EVALUATION OF MTF FOR TESTING HAZARDOUS MATERIAL SPILL CONTROL EQUIPMENT Final Report, Jun. 1972 - Aug. 1974
Charles R. Thomas, George M. L. Robinson, and Edward J. Martin (Environ. Quality Systems, Inc.) Dec. 1974 308 p refs Prepared in Cooperation with Environ. Quality Systems, Inc.
(Grant EPA-S-801830)
(PB-240762/5; EPA-670/2-74-073) Avail: NTIS MF $9.25 CSCL 13B

The Mississippi Test Facility, Bay St. Louis, Mississippi, is evaluated as a potential location for safely testing and demonstrating equipment designed to control hazardous materials spills. All factors which influence the selection of an appropriate site are examined with special emphasis on the assured protection of the environment. A 100-acre site located in the Northeastern Buffer Zone is recommended to conduct a three-phase development program. The program includes detailed initial and continuing environmental baseline monitoring, construction and operation of a semi-closed test facility, and continuing analysis and upgrading of program elements. GRA

N75-28575# Lake Tahoe Area Research Coordination Board, South Lake Tahoe, Calif.
PROCEEDINGS OF THE LAKE TAHOE RESEARCH SEMINAR 2
27 Sep. 1974 89 p refs Conf. held at South Lake Tahoe, Calif., 27 Sep. 1974 Prepared in cooperation with Lake Tahoe Environmental Education Consortium, South Lake Tahoe, Calif.
(Grant NSF GT-39556)
(PB-240549/6; NSF/RA/G-74-012) Avail: NTIS HC $4.75 CSCL 13B

Research projects dealing with waste treatment, soil erosion, air pollution, and environmental quality in the Tahoe Basin are discussed. J.M.S.

N75-28576# Holt (Ben) Co., Pasadena, Calif.
EXPERIMENTAL PROTOTYPE OILY WASTEWATER TREATMENT SYSTEM Final Report, 27 Aug. 1973 - 30 Mar. 1974
30 Mar. 1974 62 p
(Contract N62399-74-C-0004)
(AD-A004990; CEL-CR-74-008) Avail: NTIS CSCL 07/1

An experimental prototype oily wastewater treatment system rated at 20 gpm consists of three stages: a parallel corrugated plate gravity separator, a coalescer with prestrainer and prefilter and two carbon columns for removing oil from mechanical emulsions in water of varying salinity, as well as organic moieties for different levels of disposal options. The system is to be evaluated and modified as a test bed for further development prior to field test. GRA

N75-28577# Environmental Research Inst. of Michigan, Ann Arbor. Infrared and Optics Div.
IN-SITU DETECTION OF OIL SLICKS UTILIZING DIFFERENTIAL EVAPORATION. PHASE 2: SYSTEM DESIGN Final Report
Robert Horvath, Edward F. Lirette, and David M. Zuk Mar. 1974 37 p refs
(Contract DOT-CG-33996-A)
(AD-A005083; ERIM-103900-9-F) Avail: NTIS CSCL 14/2

This technical report describes the detailed design phase of a sensor system development program. The development is based upon a unique oil detection technique which utilizes fundamental differences in thermodynamic evaporation properties between liquids. The basic detection concept is defined, and the design parameters of the several subsystems required for implementation as a self-contained sensor system is described. Design features required to insure operability and survivability in a harbor or river marine environment are emphasized. Servicing requirements for replacement of expendable stores are also discussed. GRA

N75-28578# Boeing Aerospace Co., Seattle, Wash.
EMPIRICALLY DERIVED TRANSFER FUNCTIONS THREAT ENVIRONMENT TO INTERNAL ENVIRONMENT (S-ZONE) RLOB Final Report
4 Dec. 1974 27 p refs
(Contract DACA87-72-C-0002)
(AD-A005621; TM-84) Avail: NTIS CSCL 15/3

Magnetic-field transfer functions for outside-to-inside test positions are presented. The transfer functions were determined from the RLOB Site Test 5 test data. In addition, comparison is made between transfer functions derived from test data and calculated transfer functions. GRA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation*.

N75-28579 British Library Lending Div., Boston Spa (England).
THE DISTRIBUTION OF WATER TEMPERATURE ANOMALIES IN THE NORTH ATLANTIC AT A TIME OF LARGE AIR TEMPERATURE ANOMALIES OVER THE CONTINENT
E. G. Apasova [1974] 11 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 107, 1972 p 72-79

(BLL-M-23570-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The thermal effect is considered of the North Atlantic on the formation of extreme positive and negative air temperature anomalies in the western U.S.S.R. It is shown that the maximum quantity of heat passes from the ocean to the atmosphere along the coast of Norway in the 60 - 70 deg N zone. This heat arises from the evaporation of ocean waters and from turbulent heat exchange with the ocean. Heat losses from the ocean surface are compensated by heat imports borne by the North Atlantic and Norwegian Currents, which pass through this very region. It is concluded that the thermal state of the Atlantic affects the temperature regime of the continent through the medium of atmospheric circulation. Author

N75-28580 British Library Lending Div., Boston Spa (England).
STRATOSPHERIC ANTICYCLONES IN THE PERIODS OF THE EASTERLY AND WESTERLY PHASES OF THE QUASI-BIENNIAL EQUATORIAL CYCLE
N. Ja. Soloveva [1974] 9 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), no. 107, 1972 p 29-37
(BLL-M-23555-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The intensity and position of the stratospheric anticyclones on the 10mb surface is determined in relationship to the wind cycle phase (westerly or easterly) prevailing in the equatorial stratosphere. Charts were compiled for the mean monthly position of the axes and trajectories of the anticyclones for each month of the winter and the characteristics of the stratospheric circulation examined. Results are presented and discussed. J.M.S.

N75-28581 British Library Lending Div., Boston Spa (England).
EFFECT OF THE SEASONAL RE-DISTRIBUTION OF HEAT IN THE EARTH-ATMOSPHERE SYSTEM ON AIR TEMPERATURE
L. A. Stokina and M. A. Vasisceva [1974] 14 p refs Transl. into ENGLISH from Tr. Glav. Geofiz. Observ. (Leningrad), v. 287, 1971 p 52-63
(BLL-M-23539-(5828.4F)) Avail: British Library Lending Div., Boston Spa., Engl.: 2 BLL photocopy coupons

The seasonal redistribution of heat in the earth-atmosphere system, as caused by the annual cycle in the influx of solar radiation is considered along with redistribution of heat as a result of the variation in the enthalpy of the oceans. The transfer of heat by horizontal motions in the oceans and the atmosphere is included. The connection between changes in the ocean's enthalpy and the general horizontal transfer of heat throughout the earth-atmosphere system, and the incoming radiation at the outer atmospheric boundary and the temperature of the lower atmospheric layer is discussed. It is concluded that the current-borne heat transport (as a part of the general meridional heat transport in the earth-atmosphere system) and oceanic enthalpy are significant factors in the formation of the surface thermal regime. J.M.S.

N75-28582 British Library Lending Div., Boston Spa (England).
ON THE NATURE OF THE SEMIANNUAL WIND OSCILLATION IN THE UPPER STRATOSPHERE OF THE EQUATORIAL ZONE
H. P. Pogosjan [1974] 9 p refs Transl. into ENGLISH from Meteorol. Gidrol. (Leningrad), no. 3, 1972 p 16-23
(BLL-M-23549-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Results are given of research into the nature of oscillation of the wind in the upper stratosphere and lower mesosphere of the equatorial zone. It is shown that the easterly and westerly winds characteristic of the fundamental seasons are determined in the transitional seasons not by marked temperature fluctuations at the equator itself, but by seasonal changes in the temperature field in high, and especially middle, latitudes. It is concluded that the six month oscillation is a periodic seasonal phenomenon comparable to the summer easterly circulation, and the winter westerly circulation, in the stratosphere. Author

N75-28583 British Library Lending Div., Boston Spa (England).
TURBULENCE NEAR THE TROPOPAUSE IN THE PRESENCE OF OROGRAPHIC WAVES
G. S. Buldovskij [1974] 10 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 95, 1972 p 17-26
(BLL-M-23562-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The effect of orographic waves on the development of turbulence near the tropopause is investigated. Conditions of bumpiness near the tropopause over mountainous regions are considered as well as the concomitant distribution of turbulence in the tropopause and the lower stratosphere. Aircraft data on turbulence over the Caucasus was obtained during the combined flights of research aircraft at various levels and during solo flights of the high altitude aircraft laboratory conducted in the tropopausal layer and the lower stratosphere. Evidence of the existence of orographic waves during the flights was provided by the periodic regularities in air motions as recorded by the aircraft. The aircraft data provides a basis for the distribution of the probability of bumpiness in the tropopause, tropopausal layer, and the lower stratosphere on the lee of a ridge under meteorological conditions favoring orographic waves. Results indicate a relationship between bumpiness in the tropopausal layer and vertical wind shear, and the difference in temperature gradients below and above the level of the tropopause. J.M.S.

N75-28584 British Library Lending Div., Boston Spa (England).
AN ANALYTICAL DESCRIPTION OF THE MAGNETIC FIELD OF BYGONE EPOCHS, AND A DETERMINATION OF THE SPECTRUM OF MAGNETIC WAVES IN THE EARTH'S CORE
S. I. Braginskij [1974] 18 p refs Transl. into ENGLISH from Akad. Nauk, Geomag. Aeron. (Moscow), v. 12, 1972 p 1092-1105
(BLL-M-23573-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

An approximate analytical representation of the fundamental geomagnetic field over the last 1500 years is given in the form of a superimposition of a small number of running waves. The field approximation may be interpreted as the representation of variations in the geomagnetic field in the form of the superimposition of fields connected with magnetic waves propagated in the earth's core. The wave spectrum obtained is examined. An estimation is given of the toroidal field in the earth's core. Author

N75-28585 British Library Lending Div., Boston Spa (England).
AIRCRAFT INVESTIGATIONS OF THE MICROSTRUCTURE OF THE TEMPERATURE FIELDS IN THE TROPOSPHERE AND STRATOSPHERE
V. P. Baljaev [1974] 8 p Transl. into ENGLISH of conf. paper from Gidromet. Inst. Presented at All Union Conf. on Problems Met. Safety Supersonic Aviation, 24-26 Mar. 1971 p 306-312
(BLL-M-23558-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Meteorological information for supersonic aircraft requires a knowledge of the temperature regime on all sections of the flight path (in the troposphere and in the lower stratosphere). Experimental data were obtained on the temperature of the air and its fluctuations from ground level up to heights of 20 to 25 km. The automatic electrical thermometer for aircraft measures the mean temperature and its fluctuations from aircraft flying at subsonic speeds. With a thermo-anemometer measurements were made of the fluctuations in air speed of the aircraft synchronously with temperature. Author

N75-28586 British Library Lending Div., Boston Spa (England).
THE TWO YEAR CYCLE IN ATMOSPHERIC CIRCULATION
V. A. Bugaev [1974] 21 p refs Transl. into ENGLISH from Gidromet. Nauc. Issled. Cent. (SSSR), 1972 p 68-78
(BLL-M-23409-(5828.4F)) Avajl: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

The general circulation of the atmosphere was investigated. Within this system biennial fluctuations form initially in the equatorial stratosphere, and are subsequently propagated on a global scale throughout the stratosphere and troposphere. There is a quasibiennial interchange of westerly and easterly winds between the 18 and 35 km levels in the narrow equatorial

zone ten degrees either side of the equator. Observations up to 1967 indicate an average period of 26 months, fluctuating between extremes of 21 and 30 months. Author

N75-28587 Colorado State Univ., Fort Collins.
THE GENERATION OF SECONDARY ICE PARTICLES IN CLOUDS BY CRYSTAL-CRYSTAL COLLISION Ph.D. Thesis
Larry Vardiman 1974 135 p
Avail: Univ. Microfilms Order No. 75-14681

The number of fragments generated by crystal collisions in a cloud is a product of the number of fragments produced per collision and the collision frequency. The fragment generation function was obtained experimentally by photographing at high speed, collisions of natural ice crystals with a fixed plate. The number of fragments in a collision was found as a function of the change in momentum upon impact with the fixed plate and as a function of crystal type and degree of rime. The difference in the change in momentum for collisions in a cloud compared to the fixed plate is treated theoretically and developed into a mathematical model. The collision frequency is incorporated into the model and rates of fragment generation studied for different crystal combinations sizes, and concentrations. The model predictions were verified by several qualitative studies and one quantitative case study. The case studies confirm the model predictions quite well when applied to typical natural and seeded cloud conditions. The additional crystals generated in smooth stratiform clouds may reach a maximum of ten times the expected natural crystal concentration at or near cloud base.
Dissert. Abstr.

N75-28588 Missouri Univ., Rolla.
NUMERICAL SIMULATION OF HEAT, MASS, AND MOMENTUM TRANSFER IN AN ATMOSPHERIC BOUNDARY LAYER Ph.D. Thesis
Darrell Weldon Pepper 1973 200 p
Avail: Univ. Microfilms Order No. 75-15844

Efforts made to understand transport phenomena in thermally stratified boundary layers are reported. The atmospheric boundary layer is modeled using the equations of continuity, momentum, energy, and concentration. Using turbulence kinetic energy, the system of equations is closed by internally determining the exchange coefficients of heat, mass, and momentum along with other atmospheric parameters. This approach makes it possible for the history of turbulent motion to be taken into account. Verification of this model is made by systematically comparing the numerical results with available wind tunnel data for neutral, stable, and unstable conditions. Application of the model is made to study the formation of advection fogs occurring over cold sea surfaces. However, the predicted results of liquid water and water vapor contents have yet to be verified with actual data obtained from field measurements. Dissert. Abstr.

N75-28589 Utah Univ., Salt Lake City.
MOMENT METHODS FOR SOLVING ASYMMETRICALLY DRIVEN RF PROBES IN THE COLLISIONAL IONOSPHERIC MAGNETOPLASMA Ph.D. Thesis
Hyun-Shik Hwang 1974 179 p
Avail: Univ. Microfilms Order No. 75-14443

The moment method is discussed, and the application of this method for solving asymmetrically driven RF probes in the collisional and warm ionospheric magnetoplasma is presented. The first three velocity moments of the Boltzmann transport equations are used for the description of the plasma. The plasma equations and Maxwell's equations are solved simultaneously using Cohen's mode separation method. No interrelation between the electromagnetic mode and the plasma mode is assumed. The effects of these two modes on the antenna impedance are compared and it is shown that the electromagnetic effect is negligible with respect to the plasma effect under certain conditions. The antenna is divided conceptually into small segments and the self impedance of a small segment is calculated using the quasi-static approximation. Dissert. Abstr.

N75-28590 British Library Lending Div., Boston Spa (England).
CALCULATING THE INITIAL VOLTAGES OF AN ELECTRICAL DISCHARGE IN AIR
E. S. Kolechitckii and N. A. Melikov [1974] 17 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 5, 1973 p 78-82 In ENGLISH and RUSSIAN
(BLL-M-23453-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Equations for the self-dependence of electric discharge were used for calculating the initial voltages in gaps where there is a gaseous medium. Problems connected with the methods for conducting these calculations are discussed. M.J.S.

N75-28591 Institut d'Aeronomie Spatiale de Belgique, Brussels.
EXOSPHERIC MODELS OF THE TOPSIDE IONOSPHERE
J. Lemaire and M. Scherer 1974 90 p refs Submitted for publication
(Aeronomica-Acta-A-128-1974) Avail: Issuing Activity

The historical evolution of the study of escape of light gases from planetary atmospheres is outlined, and the application of kinetic theory to the ionosphere is discussed. Ionospheric plasma becomes collisionless above the ion-exobase which is located near 1000 km altitude in the trough and polar regions, and which coincides with the plasmapause at lower latitude. When the boundary conditions at conjugate points of a closed magnetic field lines are different, interhemispheric particle fluxes exist from the high temperature point to the low temperature point, and from the point of larger concentrations to the point of smaller concentrations; therefore the charge separation electric field in the exosphere is no longer given by the Pannekoek-Rosseland field. For field aligned current densities along auroral field lines smaller than 0.00001 A/sq m, the potential difference between the ion-exobase and plasmasheet is about -3 volts. In the case of open magnetic field lines the flow speed of hydrogen and helium ions in the exosphere becomes rapidly supersonic as a consequence of the upward directed charge separation electric field, whereas the oxygen ions have a negligible small bulk velocity. Adding a photoelectron efflux decreases the thermal electron escape but does not change significantly the number density distributions. Author (ESRO)

N75-28592 Institut d'Aeronomie Spatiale de Belgique, Brussels.
GENERALIZED INVARIANT FOR A CHARGED PARTICLE INTERACTING WITH A LINEARLY POLARIZED HYDROMAGNETIC PLANE WAVE
M. Roth 1974 30 p refs Submitted for publication
(Aeronomica-Acta-A-130-1974) Avail: Issuing Activity

A generalized invariant for a charged particle motion in the electromagnetic field of a linearly polarized hydromagnetic plane wave is formulated analytically. The propagation is in the direction of a uniform magnetic field and it is assumed that the magnetic field of the wave is weak. Using a canonical transformation, the invariant J is developed to the first order in the modulation amplitude. It is shown that the curves J = constant represent satisfactorily the orbits in phase space. Author (ESRO)

N75-28593 Institut d'Aeronomie Spatiale de Belgique, Brussels.
IONOSPHERE-PLASMASHEET FIELD-ALIGNED CURRENTS AND PARALLEL ELECTRIC FIELDS
J. Lemaire and M. Scherer 1974 17 p refs Submitted for publication
(Aeronomica-Acta-A-135-1974) Avail: Issuing Activity

Kinetic models for the auroral topside ionosphere are compared. The collisionless plasma distributed along an auroral magnetic field line behaves like a nonohmic conducting medium with highly nonlinear characteristic curves relating the parallel current density to the potential difference between the cold ionosphere and the hot plasmasheet region. The (zero electric current) potential difference required to balance the current carried by the precipitating plasmasheet particles and the current transported by the outflowing ionospheric particles, depends on the plasmasheet properties and ionospheric electron densities and temperatures. When in the E-region the magnetic field lines are interconnected by a high conductivity plasma the resulting field-aligned currents driven by the magnetospheric potential distribution are limited by the integrated Pedersen conductivity layers. These currents are not related to the parallel electric field intensity as it would be in ohmic materials. The parallel electric field intensity is necessarily determined by the local quasi-neutrality of the plasma. Author (ESRO)

N75-28594*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

DOWNWARD CONTINUATION OF GRAVITY INFORMATION FROM SATELLITE TO SATELLITE TRACKING OR SATELLITE GRADIOMETRY IN LOCAL AREAS
R. Rummel Apr. 1975 54 p refs
(Grant NGR-36-008-161; OSURF Proj. 3210)
(NASA-CR-143236; Rept-221) Avail: NTIS HC $4.25 CSCL 08N

Integral formulas in the parameter domain are used instead of a representation by spherical harmonics. The neglected regions will cause a truncation error. The application of the discrete form of the integral equations connecting the satellite observations with surface gravity anomalies is discussed in comparison with the least squares prediction method. One critical point of downward continuation is the proper choice of the boundary surface. Practical feasibilities are in conflict with theoretical considerations. The properties of different approaches for this question are analyzed. Author

N75-28595*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.
BASIC RESEARCH AND DATA ANALYSIS FOR THE EARTH AND OCEAN PHYSICS APPLICATIONS PROGRAM AND FOR THE NATIONAL GEODETIC SATELLITE PROGRAM Semiannual Status Report, Jan. - Jun. 1975
Jul. 1975 65 p refs
(Grant NGL-36-008-093; NGR-36-008-204; OSURF Proj. 3820-A1; OSURF Proj. 2514)
(NASA-CR-143212; SASR-4; SASR-16) Avail: NTIS HC $4.25 CSCL 08E

Data acquisition using single image and seven image data processing is used to provide a precise and accurate geometric description of the earth's surface. Transformation parameters and network distortions are determined. Sea slope along the continental boundaries of the U.S. and earth rotation are examined, along with close grid geodynamic satellite system. Data are derived for a mathematical description of the earth's gravitational field; time variations are determined for geometry of the ocean surface, the solid earth, gravity field, and other geophysical parameters. J.A.M.

N75-28596*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE SOURCE OF THE ELECTRIC FIELD IN THE NIGHTSIDE MAGNETOSPHERE
David P. Stern Jun. 1975 27 p refs
(NASA-TM-X-70837; X-602-75-17) Avail: NTIS HC $3.75 CSCL 03B

In the open magnetosphere model magnetic field lines from the polar caps connect to the interplanetary magnetic field and conduct an electric field from interplanetary space to the polar ionosphere. By examining the magnetic flux involved it is concluded that only slightly more than half of the magnetic flux in the polar caps belongs to open field lines and that such field lines enter or leave the magnetosphere through narrow elongated windows stretching the tail. These window regions are identified with the tail's boundary region and shift their position with changes in the interplanetary magnetic field, in particular when a change of interplanetary magnetic sector occurs. The circuit providing electric current in the magnetopause and the plasma sheet is extended across those windows; thus energy is drained from the interplanetary electric field and an electric potential drop is produced across the plasma sheet. The polar cap receives its electric field from interplanetary space on the day side from open magnetic field lines and on the night side from closed field lines leading to the plasma sheet. The theory described provides improved understanding of magnetic flux bookkeeping, of the origin of Birkeland currents, and of the boundary layer of the geomagnetic tail. Author

N75-28597*# Illinois Univ., Urbana.
AN INVESTIGATION OF THE SOLAR ZENITH ANGLE VARIATION OF D-REGION IONIZATION
P. A. J. Ratnasiri and C. F. Sechrist, Jr. 1 Apr. 1975 290 p refs
(Grants NGR-14-005-181; Grant NSF GA-36911X)
(NASA-CR-143217; ISSN-0568-0581; Aeronomy-67; UILU-ENG-75-2504) Avail: NTIS HC $8.75 CSCL 04A

Model calculations are carried out with a view to interpreting the solar zenith angle variation of D-region ionization. A model is developed for the neutral chemistry including the transport terms relating to molecular and eddy diffusion. The diurnal behavior is described of the minor neutral constituents formed in an oxygen-hydrogen-nitrogen atmosphere, in the height interval between 30 and 120 km. Computations carried out for two cases of the eddy diffusion coefficients models indicate that the constituents which are important for the D-region positive-ion chemistry do not show a significant variation with zenith angle for values up to 75 deg over the D-region heights. In the ion chemistry model, ion-pair production rates are calculated for solar X-rays between 1 A and 100 A, EUV radiations from 100 A up to the Lyman-alpha line, precipitating electrons, and galactic cosmic rays. The solar zenith angle variation of the positive-ion composition, negative-ion composition, and the electron densities are described up to 75 deg zenith angle, in the height interval between 60 and 100 km. Author

N75-28598*# Illinois Univ., Urbana. Aeronomy Lab.
RESEARCH IN AERONOMY Progress Report, 1 Apr. - 30 Sep. 1974
Belva Edwards, ed. 30 Sep. 1974 192 p refs
(Grants NGR-14-005-181)
(NASA-CR-143216; PR-74-2) Avail: NTIS HC $7.00 CSCL 04A

The effects of atmospheric dynamics on the ionosphere are investigated along with the D-, E-, and F-region structure and composition. Various techniques used for atmospheric studies including rocket sounding, meteorological radar, incoherent scattering, and partial reflection are discussed. Monte Carlo sampling techniques are applied to simulate the physical processes involving particle collisions, chemical reactions, and wave propagation in the ionosphere. J.M.S.

N75-28599# Naval Oceanographic Office, Washington, D.C.
TECTONIC HISTORY OF THE ARCTIC BASINS: PARTIAL SOLUTIONS AND UNSOLVED MYSTERIES, CHAPTER 3
Peter R. Vogt and Otis E. Avery 15 Jan. 1974 39 p refs
Repr. from Mar. Geol. and Oceannog. of the Arctic Seas, 1974 p 83-117
(NR Proj. 083-284)
(AD-A005411) Avail: NTIS CSCL 08/7

As yet inaccessible to deep-sea drilling and shipborne surveying, the ice-locked Arctic Basin has been slow to give up details of crustal genesis and later modification. Extensive geophysical surveying both in the Arctic Basin and the North Atlantic confirms sea-floor spreading as the only probable mode of crustal genesis for the Eurasia Basin. Magnetic anomalies, although less clear than elsewhere suggest spreading rates of approximately 0.5 to 1 cm/yr since 10 m.y.b.p.; the basin was born perhaps 60 m.y.b.p., with the separation of the Lomonosov Ridge from the Eurasian margin. GRA

N75-28600# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A TECHNIQUE FOR EVALUATING MATHEMATICAL MODELS OF THE MAGNETOSPHERE
D. F. Smart and M. A. Shea 1974 13 p refs Repr. from Proc. of Intern. Symp. on Solar-Terrest. Phys., Magnetosphere (Sao Paulo), v. 2, 1974 p 134-143
(AF Proj. 8600; AF Proj. 6813)
(AD-A005384; AFCRL-TR-75-0051) Avail: NTIS CSCL 04/1

A technique for evaluating mathematical models of the magnetosphere using neutron monitor observations of anisotropic ground-level solar cosmic-ray events is presented. This technique is based upon previously demonstrated success in determining the spectra and spatial anisotropy of the November 18, 1968 cosmic-ray increase. The earlier work assumed that the asymptotic directions of cosmic-ray particles for neutron monitor stations were known from which the relative increases could be numerically calculated resulting in a unique spectral slope, degree of anisotropy, and direction of the relativistic solar particle flux. Considering that the calculated asymptotic directions for high latitude neutron monitors somewhat differ depending upon the configuration of the magnetospheric model utilized, sets of asymptotic directions for high latitude neutron monitors differ depending upon the configuration of the magnetospheric model utilized; sets of asymptotic directions were calculated using

different parameters in a mathematical model of the magnetosphere. Author

N75-28601# Universities Council for Earthquake Engineering Research, Pasadena, Calif.
PROCEEDINGS OF NATIONAL MEETING OF THE UNIVERSITIES COUNCIL FOR EARTHQUAKE ENGINEERING RESEARCH (3RD)
W. D. Iwan May 1974 256 p refs Meeting held at Ann Arbor, 9-10 May 1974
(Grant NSF GI-32568)
(PB-240657/7; UCEER-3) Avail: NTIS HC $8.50 CSCL 13B

The volume contains reports of Earthquake Engineering Research in progress at 34 universities. Also included are summaries of the deliberations of working subgroups in the areas of ground motion instrumentation and characterization, soil mechanics and soil structure interaction, analytical and numerical techniques, experimental techniques, earthquake resistant design, seismic risk, and codes, and damage surveys for major earthquakes. GRA

N75-28602# Texas Univ. at Dallas, Richardson.
A PROGRAM OF MARINE GEOPHYSICAL RESEARCH Final Report
A. L. Hales Feb. 1975 8 p refs
(Contract N00014-67-A-0310-0005; NR Proj. 083-601)
(AD-A005313) Avail: NTIS CSCL 08/7

During the ten year period from 1964 to 1974 a program in marine geophysical research was undertaken by the University of Texas at Dallas. Initially, the program emphasized deep ocean studies including seismic refraction measurements using a single ship and a number of free floating buoys. This work was complemented by continuous seismic reflection profiling. Subsequent studies focused on the continental margins. Continental margin studies were conducted on the east coast of North America, three transects of the margins of the Gulf of Mexico, in the western part of the Coral Sea, and off the coasts of South Africa and Columbia, South America. This report lists papers published as a result of the studies. GRA

N75-28603# Scripps Institution of Oceanography, San Diego, Calif. Marine Physical Lab.
FRACTURE ZONE A, MID-ATLANTIC RIDGE 37 DEG N: A NEAR BOTTOM GEOPHYSICAL STUDY
Robert S. Detrick 1 Oct. 1974 14 p refs
(Contract N00014-69-A-0200-6002; Grants NSF GA-31377; NSF GA-41358; NR Proj. 260-103)
(AD-A005424; SIO-Ref-74-26; MPL-U-54/74) Avail: NTIS CSCL 08/16

A near-bottom geophysical survey has been made of a small transform fault, designated Fracture Zone A, located on the Mid-Atlantic Ridge near 37N. Morphologically, Fracture Zone A is defined by a broad U-shaped valley that is widest and deepest near its intersection with the adjacent rift valleys. The walls of Fracture Zone A are structurally complex with both E-W and N-S trending scarps; however, the main trend of the transform fault valley is determined by several prominent E-W trending scarps giving the valley a graben-like appearance. While the transform fault valley itself is several kilometers in width, the actual zone of decoupling across Fracture Zone A presently occurs over a very narrow and readily identifiable zone. Structural lineations mapped within the transform fault valley generally parallel the trend of the rift valley, indicating that this crust was probably generated by normal sea-floor spreading processes. GRA

N75-28604# California Inst. of Tech., Pasadena. Earthquake Engineering Research Lab.
ANALYSES OF STRONG MOTION EARTHQUAKE ACCELEROGRAMS. VOLUME 3: RESPONSES SPECTRA. PARTS Q AND R: ACCELEROGRAMS IIQ233 THROUGH IIQ243, IIR244 THROUGH IIR254
M. D. Trifunac, A. G. Brady, and D. E. Hudson Oct. 1974 288 p refs
(Grant NSF GK-28098)
(PB-240688/2; EERL-74-85-Vol-3-Pt-Q/R) Avail: NTIS HC $8.75 CSCL 08K

Earthquake response spectrum curves calculated from corrected accelerograms are presented. For each earthquake accelerogram, two spectrum plots are given relative velocity response versus period on a linear scale, and a tripartite log-log plot giving relative displacement, pseudo-velocity, and pseudo-acceleration spectra. The Fourier spectrum is also shown on the linear plot. Digital printout of ordinates of the plotted curves are tabulated for each earthquake. GRA

N75-28605# Aerospace Corp., El Segundo, Calif. Lab. Operations.
BAND MODEL CALCULATIONS OF ATMOSPHERIC TRANSMITTANCE FOR HOT GAS LINE EMISSION SOURCES Interim Report
Stephen J. Young 31 Dec. 1974 104 p
(Contract F04701-74-C-0075)
(AD-A005632; TR-0075(5647)-1; SAMSO-TR-74-248) Avail: NTIS CSCL 04/1

A band model formulation designed for computing the effective transmittance of the atmosphere to hot H2O/CO2 plume emission sources has been presented and discussed in detail. The effects of line correlation between the plume emission spectrum and the atmospheric H2O/CO2 absorption spectrum are accounted for by treating the entire optical path extending from the sensor position through the intervening atmosphere and including the hot emission source as a single radiating/absorbing entity. The high degree of inhomogeneity and nonisothermality of such an optical path are accounted for by either the Curtis-Godson or Lindquist-Simmons approximation. Calculations within this formulation and appropriate to the viewing geometries of satellite surveillance systems and aircraft-to-aircraft field measurements programs have been performed. For selected wide spectral bandpass regions, the effect of line correlation is shown to result in discrepancies of as much as a factor of 3 between currently calculated and correctly calculated average transmittance values. GRA

N75-28606# Panametrics, Inc., Waltham, Mass.
CORRELATION OF AURORAL SUBSTORM PARTICLE SPECTRA WITH ASSOCIATED ATMOSPHERIC EFFECTS Final Report, 29 Jan. 1973 - 30 Sep. 1974
Bach Sellers and Frederick A. Hanser Nov. 1974 114 p refs
(Contract F19628-73-C-0098; AF Proj. 7601)
(AD-A005659; AFCRL-TR-74-0585) Avail: NTIS CSCL 04/1

Results are presented from a study of the correlation of auroral zone rocket-measured particle spectra with the associated atmospheric effects. Particle results from three substorms at Ft. Churchill, Canada in 1970-72 are presented, and the 1970 event is analyzed in detail. Emphasis is placed on 3914 A optical emission and 30 MHz RF absorption. Particle spectra in the 1-15 keV region are used to calculate the resulting total 3914 A emission, and this is correlated with results from ground-based photometers. A general method of calculating the altitude profile of energy deposition due to energetic electrons is given, including both collisional and bremsstrahlung effects. The method is used in development of expressions for high frequency riometer absorption. It is then applied to the rocket measured energetic (greater than 15 keV) electron spectra, and results are compared with those from the ground-based polar riometer. GRA

N75-28607# Old Dominion Systems, Inc., Gaithersburg, Md.
GEOPOTENTIAL DETERMINATION FROM SATELLITE TO SATELLITE TRACKING AND SATELLITE ALTIMETRY Final Report
J. G. Hartwell, G. E. Morduch, and F. M. Loveless Feb. 1975 81 p refs
(Contract DAAK02-73-C-0455)
(AD-A005213; ETL-CR-74-21) Avail: NTIS CSCL 08/5

A study has been made to determine the accuracy with which geopotential may be recovered using the principle of conservation of energy. The improvement resulting from the use of altimeter measurements over selected oceans areas was also investigated. Satellite position and velocity were determined by using range and range rate measurements for a system (621B) of high orbiting satellites whose own positions and velocities had previously been determined by ranging from known ground stations. GRA

N75-28608# Army Foreign Science and Technology Center, Charlottesville, Va.
EXPERIENCE GAINED AT GEODETIC OPERATIONS IN NORTHERN REGIONS
I. G. Barzenkov and B. V. Eliseev Feb. 1974 6 p ref Transl. into ENGLISH from Geod. Kartografiya (USSR), no. 9, 1972 p 11-13
(AD-A004976; FSTC-HT-23-1601-73) Avail: NTIS CSCL 08/5

The carrying out of geodetic work in Northern regions is briefly discusses. The differences of working in these latitudes and measures taken to provide accurate, up-to-date information are described. Methods of supplying and equipping the expeditions are discussed. GRA

N75-28609# Teledyne Geotechnical, Alexandria, Va. Seismic Data Lab.
AVERAGE P AND PKP CODAS FOR EARTHQUAKES
E. I. Sweetser, T. J. Cohen, and M. F. Tillman 12 Nov. 1973 201 p refs
(Contract F33657-72-C-0009; ARPA Order 1714)
(AD-A004960; SDL-305) Avail: NTIS CSCL 08/11

Large and small event seismograms recorded throughout the world indicate that coda shape is primarily a function of the arrival times and relative amplitudes of significant secondary arrivals. However, for times greater than 10 to 20 seconds into the coda, large event codas are approximately 0.14 m(b) units greater in amplitude at any given time relative to their maxima, than the corresponding relative amplitude for small event codas. This suggests that large events are multiple events, with the nominal period of source activity for a given sequence estimated to be on the order of 1 to 2 minutes. Correspondingly, large events also tend to be emergent, displaying a 0.2 to 0.3 m(b) increase in amplitude between 5 and 30 seconds into the P-wave arrival over that observed in the first 5 seconds of the arrival. Because of their differences, large event and small event coda observations cannot be combined. GRA.

N75-28610# Barcelona Univ. (Spain). Dept. de Fisica de la Tierra y del Cosmos.
PROPAGATION AND SOURCE PARAMETERS FROM LONG-PERIOD HIGH-GAIN SEISMOGRAPHS Annual Technical Report, 1 Oct. 1973 - 30 Sep. 1974
Agustin Udias 31 Oct. 1974 17 p refs
(Grant AF-AFOSR-2609-74; ARPA Order 1827)
(AD-A005717; AFOSR-75-0245TR) Avail: NTIS CSCL 08/11

Earthquake parameters were analyzed using data from the analog and digital outputs of high gain-long period stations. Results from these stations were compared with those of WWSSN stations. GRA

N75-28611# Teledyne Geotechnical, Garland, Tex.
STRAIN/INERTIAL SEISMOGRAPH COMPLEXES
James E. Fix 5 Mar. 1974 275 p refs
(Contract F08606-73-C-0008; AFTAC Proj. T/3703)
(AD-A005708; TR-73-16) Avail: NTIS CSCL 08/11

The purposes of this report are to present the results of a comprehensive review of the state-of-the-art of strain seismographs and their applications and to present the cost/performance tradeoffs between spatial arrays and strain/inertial arrays. The review included: strain seismometer operating characteristics, present designs, and possible future designs; installation methods, techniques, and configurations; applications of combined strain and inertial seismograms including detection thresholds of the prototype station; the character and magnitude of the strain noise field; and budgetary costs for typical installations. GRA

N75-28612# St. Louis Univ., Mo. Dept. of Earth and Atmospheric Sciences.
RESEARCH ON SEISMOLOGY Semiannual Technical Report, 1 May - 31 Oct. 1974
William Stauder 1974 68 p refs
(Contract F44620-73-C-0042; ARPA Order 1827)
(AD-A005665; AFOSR-75-0265TR) Avail: NTIS CSCL 08/11

Contents: Spectral characteristics of the Lg wave generated by Central U.S. earthquakes; Ground motion modelling at regional distances for earthquakes in a continental interior; Regional Rayleigh wave attenuation in North America; Surface wave attenuation in Eurasia; Radiation from shallow focus earthquakes in the Sakhalin and Kurile Islands. GRA

N75-28613# Teledyne Geotechnical, Alexandria, Va. Seismic Data Analysis Center.
THE EFFECTS OF REDUCED CONFIGURATIONS AT (LASA) ON DETECTION SIGNAL-TO-NOISE RATIOS
E. F. Chiburis, R. O. Ahner, A. C. Chang, and A. U. Kerr 3 May 1974 36 p refs
(Contract F08606-74-C-0006; ARPA Order 1620)
(AD-A004991; SDAC-TR-74-7) Avail: NTIS CSCL 17/10

The effects of varying the configuration of the Large Aperture Seismic Array (LASA) on the detection signal-to-noise ratio observed in the Seismic Data Analysis Center Detection Processor are discussed. It is shown that a configuration for the LASA of thirteen subarrays (A, B, C, and D rings) with 16 sensors per subarray produces an average loss of 0.2 plus or minus 0.3 db (one standard deviation of the mean) from the current configuration of seventeen subarrays (A, B, C, D, and E rings) using sixteen sensors per subarray. Reducing the number of subarrays to nine (A, B, and C rings) with only 7 elements per subarray produces an average loss of 3.5 plus or minus 0.3 db. These results are in general agreement with known results on variation of noise reduction and signal loss as a function of subarray and subarray sensor selection. GRA

N75-28614# Royal Norwegian Council for Scientific and Industrial Research, Kjeller.
NORWEGIAN SEISMIC ARRAY (NORSAR), PHASE 3 Semiannual Technical Report, 1 Jan. - 30 Jun. 1974
H. Bungum 1 Sep. 1974 102 p refs
(Contract F44620-74-C-0001)
(AD-A005703; NORSAR-SR-6-73/74; AFOSR-75-0338TR)
Avail: NTIS CSCL 17/10

The reports on surface wave studies include one describing a recently initiated study of source mechanisms for North Atlantic earthquakes. Work on actual explosion data includes one report on non-linear instrumental response to strong long period P-waves, and one describing the continued work on m sub b:M sub s at NORSAR. Also, a comment on the effect of multipathing on single station group velocity analysis is given. GRA

N75-28615# Weidlinger Associates, New York.
TRANAL: A3-D FINITE ELEMENT CODE FOR TRANSIENT NONLINEAR ANALYSIS Final Report, 1 Apr. 1973 - 30 Jun. 1974
J. L. Baylor, M. P. Bieniek, and J. P. Wright Jun. 1974 48 p refs
(Contract DNA001-73-C-0223)
(AD-A004979; DNA-3501F) Avail: NTIS CSCL 19/4

A finite element method for the analysis of dynamic soil-structure interaction problems associated with buried and semiburied structural complexes is outlined in some detail. A discussion of the computer program based on the finite element method is given along with a report on the status of the program. GRA

N75-28616# Denver Univ., Colo. Dept. of Mathematics.
A NUMERICAL STUDY OF INTERNAL WAVES IN THE ATMOSPHERE Final Report
David L. Hector Jan. 1975 9 p refs
(Contract AF-AFOSR-2306-72; AF Proj. 9749)
(AD-A005724; AFOSR-75-0174TR) Avail: NTIS CSCL 04/1

The particular problem studied in this research is that of the flow of an inviscid incompressible fluid of finite altitude which exhibits density and pressure stratification in the direction transverse to the flow. The fluid is bounded below and above by a solid boundary. The flows examined have been two-dimensional; the direction of the flow is taken to be the x direction and the transversa altitude variable is the z direction. None of the flow variables depend on the y coordinate, taken to be normal to the x and z directions and thus the flow is planar and takes place in the x-z plane. The report attempts to describe the perturbations created in this type flow due to the presence of a mountain ridge type barrier positioned on the lower boundary. GRA

N75-28617# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATIONS OF THE STRUCTURE OF THE ATMOSPHERIC AEROSOL
L. S. Ivlev 20 Sep. 1974 20 p refs Transl. into ENGLISH from Probl. Fiz. Atmosfery (USSR), no. 10, 1972 p 92-103
(AD-A004978; FSTC-HT-23-917-74) Avail: NTIS CSCL 04/1

Data are presented on weather conditions, altitudes, and equipment of numerous balloon measurements taken between 1964 and 1969. Discussed are meteorological conditions, skybrightness, solar radiation, and aerosol particle size distribution and concentrations at various altitudes. The majority of measurements indicate a considerable degree of stratification of aerosols above the tropopause. The data presented are said to correlate well with the measurements made by Western authors. GRA

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N75-28618 British Library Lending Div., Boston Spa (England).
AN ANALYSIS OF CASES OF STRONG TROPOSPHERIC TURBULENCE
A. A. Vasilev and N. N. Cuckalova [1974] 8 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 95, 1972 p 36-43
(BLL-M-23542-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

An analysis is presented of zones of strong turbulence recorded by an automatic instrument (sensitivity threshold 0.2g) mounted on Ilyushin 18's from December 1967 to December 1968. It was found that the extent of zones of severe turbulence is markedly shorter than that of moderate and weak turbulence, and that occasions of severe turbulence in the lower half of the troposphere are observed. The meteorological conditions of zones of severe turbulence are characterized by a combination of several turbulence-including criteria; the basic factor over mountainous regions is lee waves arising from the traversal of the mountain ridges by jet streams. M.J.S.

N75-28619 British Library Lending Div., Boston Spa (England).
SPECIAL MESO-SCALE FEATURES OF TROPICAL CONVERGENCE OVER THE ATLANTIC OCEAN
R. V. Abramov and L. V. Kool [1974] 18 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 87, 1971 p 15-31
(BLL-M-23543-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Features of the intertropical convergence zone ICZ over the Atlantic Ocean are considered which contribute to mesometeorological and synoptic fluctuations. Surface and streamline charts were used in the investigation. The position of cyclones and anticyclones was characterized by the position of their centers, that of the ICZ by its axis; the axis' position was approximated by a broken line, taking from the chart the latitude of the points where the axis intersects the separate meridians. The position of the line of wind discontinuities was similarly approximated, while that of the tropical wave is given by the coordinates of the midpoint of its trough. M.J.S.

N75-28620 British Library Lending Div., Boston Spa (England).
SCANDINAVIAN INFLUENCE AS A REFERENCE POINT IN FORECASTING THE COURSE OF THE WEATHER IN JULY
B. R. Ureva [1974] 4 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 92, 1972 p 103-105
(BLL-M-23554-(5828.4F)) Avail: NTIS Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The processes playing a part in the April migration of anticyclones from Scandinavia onto Europe were investigated for use as reference processes for forecasting weather in July. Their reliability is found to be 76% overall. Author

N75-28621 British Library Lending Div., Boston Spa (England).
ESTIMATING THE SEA-SPRAY CONTENT OF THE ATMOSPHERIC LAYER NEXT TO THE OCEAN
L. Ju Preobrazenskis [1974] 7 p refs Transl. into ENGLISH from TR. Gl. Geofiz. Observ. (Leningrad), v. 282, 1972 p 194-199
(BLL-M-23535-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The vertical and horizontal transport of particles of salt and liquid spray whipped up from the surface by turbulent wind and its effect on the structure of the sea-adjacent atmospheric layer were investigated. The presence of liquid particles in the lowest atmospheric layer above the sea was used to describe the turbulent thermal and radiation regimes of the layer. Results of the measurements of spectral composition and concentration of wind transported drops are presented and discussed. M.J.S.

N75-28622 British Library Lending Div., Boston Spa (England).
RESULTS OF THE APPLICATION OF A PHYSICOSTATISTICAL METHOD OF LONG-RANGE FORECASTING OF PRECIPITATION AND TEMPERATURE
M. I. Judin and A. V. Mescerskaja [1974] 16 p Transl. into ENGLISH from Glav. Uprav. Gidromet. Sluz. (Leningrad), v. 2, 1972 p 83-94
(BLL-M-23534-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A physico-statistical method for the long-range forecasting of hydrometeorological characteristics is presented. The method was employed in operational forecasting of precipitation and temperature in the basic agricultural regions of the European U.S.S.R. Author

N75-28623 British Library Lending Div., Boston Spa (England).
FORECASTING WINTER SEVERITY IN CENTRAL EUROPE
N. A. Aniskina and I. V. Ljapunova 9 Jul. 1974 48 p refs Transl. into ENGLISH from Gosodarst. Gidr. Inst. (Leningrad), v. 197, 1972 p 25-51 In ENGLISH and RUSSIAN
(BLL-M-23406-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 5 BLL photocopy coupons

The conditions under which air temperature anomalies are formed during winter in Central Europe are examined in terms of making long-range forecasts of the Danube's ice regime. Atmospheric circulation is analyzed in the years with warm and cold winters in order to investigate the connection between temperature regime and circulation. Conclusions are presented. J.M.S.

N75-28624 British Library Lending Div., Boston Spa (England).
THE PRESENT POSITION REGARDING THE PERFORMANCE OF THE BAROCLINIC MODEL USED IN THE GERMAN WEATHER SERVICE: RESULTS OF VERIFYING NUMERICAL FORECAST CHARTS
W. Buschner, H. Oeckel, J.-U. Schwirner, and K. O. Wegner [1974] 75 p refs Transl. into ENGLISH from Ber. der Deut. Wetterdienstes (West Germany), v. 17, no. 132, 1973 In ENGLISH and GERMAN
(BLL-M-23616-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.

The baroclinic forecasting model is described along with the quality factors used in forecasting. Average values of all computed quality factors are reported based on the results of routine forecast verification of the baroclinic prognostic maps from 1970 through 1972. Data are compiled which deal with qualitative verifications of numerical prognostic maps (including the frequencies of errors of velocity and development), with orographically conditioned errors over Central Europe which depend on the wind direction, and with the verification of wind forecasts which are of interest for the Aeronautical Weather Service. Author

N75-28625 British Library Lending Div., Boston Spa (England).
FEATURES OF ANNUAL FLUCTUATIONS IN WATER AND AIR TEMPERATURE IN THE NORTH ATLANTIC
G. N. Golovin [1974] 12 p refs Transl. into ENGLISH from Nauchn. Issled. Inst. Aeroklim. (USSR), v. 82, 1972 p 27-38
(BLL-M-23567-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The climatic peculiarities of annual variations in hydrometeorological elements are discussed. The difference between extreme

values, the time of occurrence of the extremes and the periods of the most rapid month to month changes are described as factors for the estimation of the annual fluctuations. M.C.F.

N75-28626 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF PRECEDING ATMOSPHERIC CONDITIONS ON THE FORMATION OF ANALOGICAL FIELDS OF MEAN MONTHLY AIR TEMPERATURE ANOMALIES FOR NOVEMBER IN THE NORTHERN HEMISPHERE
L. G. Borisova and T. A. Bogdanova [1974] 6 p refs Transl. into ENGLISH from Gidromet. Nauch.-Issled. Cent. SSSR (Leningrad), v. 92, 1972 p 71-76
(BLL-M-23568-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The development of synoptic processes and weather characteristics in the atmosphere on the temperature regime of November in the Northern Hemisphere is considered. An analogy of the mean monthly air temperature anomalies and the mean monthly pressure anomalies is studied. It is demonstrated that the effect of preceding synoptic processes and weather characteristics on the temperature of subsequent months is cyclic. J.M.S.

N75-28627 British Library Lending Div., Boston Spa (England).
METEOROLOGICAL PLANNING AND AIR CONDITIONING
P. Valko [1974] 20 p refs Transl. into ENGLISH from the German language document In ENGLISH and GERMAN
(BLL-M-23617-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The influence of the weather on the internal climate of high rise buildings with large areas of glass frontage is considered in terms of architectural planning. A cost-benefit analysis of insulation materials is presented. Temperature, wind speed, sunshine hours, and humidity are among the factors considered. J.M.S.

N75-28628 British Library Lending Div., Boston Spa (England).
ON THE INFLUENCE OF PRECIPITATION, INVERSION LAYERS AND TURBULENCE ON THE VERTICAL DISTRIBUTION OF LIQUID WATER CONTENT IN CONVECTIVE CLOUDS
A. L. Kazakov and R. S. Pastuskov [1974] 10 p refs Transl. into ENGLISH from Cent. Aerol. Obs. (Moscow), v. 101, 1972 p 13-21
(BLL-M-23563-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Three major factors affecting water distribution in convective clouds were studied: drop fall, the inversion layer situated above the layer of instability, and the turbulence of convection. A mathematical model of a convective cloud served as the basis for analysis. Six numerical experiments were conducted, including two control experiments for comparison purposes, and two each for studying the effects of drop fall and the retaining layers.
Author

N75-28629 British Library Lending Div., Boston Spa (England).
TROPICAL CONVERGENCE AND MAIN PATHS OF CYCLONES IN THE TROPICAL ZONE
J. S. Kruskova and A. P. Kryzanovskaja [1974] 5 p refs Transl. into ENGLISH from Gidromet. Nauch.-Issled. Cent. SSSR (Leningrad), v. 8, 1971 p 3-14
(BLL-M-23566-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Frequency charts for the intertropical convergence zone (ITCZ) and the main cyclone paths in the tropical zone are considered. Regions of the active components of the ITCZ where formation of cyclonic disturbances usually occurs are identified along with how they move, or stand still, in the convergence zone. Moderately and weakly developed areas of the ITCZ where no cyclonic disturbances originate are examined. Author

N75-28630 British Library Lending Div., Boston Spa (England).
CYCLICITY IN TEMPERATURE FLUCTUATIONS AND THE POSSIBILITY OF USING IT IN IMPROVING THE CLIMATOLOGICAL FORECAST FOR THE PRESENT FIVE-YEAR PLAN
G. T. Gnevko [1974] 9 p refs Transl. into ENGLISH from Tr. Nauch. Issled. Inst. Aeroklim. (USSR), v. 83, 1973 p 136-145 In RUSSIAN and ENGLISH
(BLL-M-23575-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The sum of the temperatures occurring during a period when values exceed 10 deg was used as an index of the thermal reserves of the vegetation period; its fluctuations in individual years are found to affect the success with which crops are cultivated at the northernmost limits of their distribution. All statistical calculations, including the sums of temperatures exceeding 10 deg were handled by a computer, using the generally accepted formulas for correlation and spectral functions. Author

N75-28631 British Library Lending Div., Boston Spa (England).
A BIOCLIMATIC APPRAISAL OF THE BLACK SEA COAST FOR HOLIDAY PURPOSES
N. A. Danilova [1974] 11 p refs Transl. into ENGLISH from Vopr. Geog. (USSR), no. 89, 1972 p 193-204
(BLL-M-23620-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

For assessing the effect of climate on man, the equivalent effective temperature (which allows for the effect of temperature, wind, and humidity) and the radiational equivalent effective temperature (which allows for incoming solar radiation) were used to study the effect of climate on man. Results are presented and discussed. M.J.S.

N75-28632 British Library Lending Div., Boston Spa (England).
ANALYSIS OF VISIBILITY CONDITIONS FOR AIRCRAFT LANDING IN RADIATION FOG
Ju. G. Konovalov and M. Ja. Racimor [1974] 7 p refs Transl. into ENGLISH from Tr. Gidromet Nauo. Issled. Cent. SSSR (Leningrad), v. 95, 1972 p 3-8
(BLL-M-23561-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Basic models of the distribution of transparency in a radiation fog are discussed which include the following: a decrease in optical density in the direction of the upper fog boundary, positioning of the layer of maximum optical density at some level above the earth's surface, and an even distribution of optical density throughout the depth of the fog. Visibility calculations are presented. M.J.S.

N75-28633 British Library Lending Div., Boston Spa (England).
TEMPERATURE FORECASTING FOR THE SUMMER MONTHS ON THE BASIS OF A STUDY OF THE EVOLUTION OF LONG PRESSURE WAVES IN THE LOWER STRATOSPHERE
B. R. Ureva [1974] 5 p refs Transl. into ENGLISH from Tr. Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 93, 1972 p 110-113
(BLL-M-23552-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A study was made of the evolution of seasonal and monthly pressure waves in the lower stratosphere (as a function of climatic macroprocesses) and of the values of the circulation indices for the Northern Hemisphere. Charts were constructed for the long-term deviations of 100 mb level from mean latitudinal values by season. Analysis of the material established that the troposphere and stratosphere differ in the number of waves only in winter, when at 100 mb in the most strongly contrasting zone (phi = 50 - 60 deg) the number of waves fell to two, while in the remaining seasons (as in the troposphere) the number of waves held at three. Author

N75-28634 British Library Lending Div., Boston Spa (England).
FUNDAMENTAL RESULTS AND PERSPECTIVES IN RESEARCH INTO THE HYDROMETEOROLOGICAL CONDITIONS OF SHIP ICING
E. P. Borisenkov and V. V. Panov [1974] 36 p refs Transl. into ENGLISH from Arkt. Antarkt. Nauchn. Issled. Inst. (Leningrad), v. 298, 1972 p 5-33
(BLL-M-23556-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 4 BLL photocopy coupons

The study of hydrometeorological conditions for icing and the search for passive and active countermeasures against icing were directed toward ensuring safe sailing conditions for ships in any hydrometeorological circumstances. Areas of study include statistical studies of hydrometeorological conditions for ship icing, natural studies of icing conditions and the physics of the phenomenon at sea, laboratory studies of icing conditions,

and theoretical studies for the calculation of the ice growth intensity on a ship under various conditions. Results of the study are presented. M.J.S.

N75-28635 British Library Lending Div., Boston Spa (England).
CHARACTERISTICS OF ATMOSPHERIC CIRCULATION IN THE NORTHERN HEMISPHERE IN THE FORMATION OF LARGE MEAN MONTHLY AIR TEMPERATURE ANOMALIES
E. G. Apasova [1974] 14 p refs Transl. into ENGLISH from Gidromet. Nauch.-Issled. Cent. SSSR, T. Vyp. (Leningrad), v. 92, 1972 p 89-102
(BLL-M-23572-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Atmospheric circulation in the middle troposphere and the stratosphere in the Northern Hemisphere (when positive air temperature anomalies are forming over the western half of the U.S.S.R.) was investigated. Features are discussed of the large-scale processes in large air temperature anomalies; these include: the interchange of upper ridges and troughs, and cyclones and anticyclones; the position of the frontal zone axis and its deformation; the intensity of zonal transport, and the depth of barometric formations and the frontal zone. M.J.S.

N75-28636 British Library Lending Div., Boston Spa (England).
ON THE CONNECTION OF CLEAR AIR TURBULENCE WITH THE EVOLUTION OF THE BAROMETRIC FIELD
A. A. Vasilev [1974] 9 p refs Transl. into ENGLISH from Tr. Gidromet. Nauc. Issled. Cent. SSSR (Leningrad), v. 95, 1972 p 27-35
(BLL-M-23550-(5928.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Clear air turbulence probability distribution charts were super-imposed on the synoptic and pressure charts for the corresponding time of observation. To determine the degree of influence of the pressure change on the probability of clear air turbulence, the mean value of the barometric tendency and the variation in the geopotential height were calculated. It was found that the probability of clear air turbulence is increased significantly where flight is over the lines of fronts at the earth's surface, and is almost independent of the surface pressure field or the barometric tendency. The probability also depends on the variation of the geopotential height at flight level. M.J.S.

N75-28637 British Library Lending Div., Boston Spa (England).
TIME FLUCTUATIONS IN THE DURATION OF THE SUMMER STRATOSPHERIC ANTICYCLONE, AND THEIR EFFECT ON WEATHER CONDITIONS
E. G. Apasova and D. A. Ped [1974] 18 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 115, 1973 p 45-55 In ENGLISH and RUSSIAN
(BLL-M-23530-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Literature on long range weather forecasting for the cold half of the year is reviewed. It is shown that weather conditions are strongly dependent on time fluctuations in the duration of the summer stratospheric high; the three classes of durations (short, mean, and long) are discussed, and calculations reveal that each class is characterized by a definite distribution of the seasonal temperature anomalies. Using these parameters, the types are clearly differentiated in the constituent seasons of the cold period, and it is established that the probability of the links increases in an absolute sense with an increase in the seasonal air temperature anomaly. Author

N75-28638 British Library Lending Div., Boston Spa (England).
MONTHLY CLIMATIC CHARACTERISTICS OF THE USSR
L. G. Konjukova, V. V. Orlova, and C. S. Sver [1974] 240 p Transl. into ENGLISH of a Russian book
(BLL-M-23410-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 24 BLL photocopy coupons

The climatology for the whole of the U.S.S.R. (all 12 months) is presented. Topics considered are: (1) the amount and type of precipitation; (2) air temperature; (3) soil temperature; (4) wind parameters; (5) cloud cover; and (6) solar radiation. J.R.T.

N75-28639 British Library Lending Div., Boston Spa (England).
VARIABILITY IN THE GENERAL MOISTNESS OF THE CONTINENTS OF THE NORTHERN HEMISPHERE
A. V. Snitnikov [1974] 261 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Zap. Geogr. Obsc. SSSR (USSR), v. 16, Nov. 1957 p 11-102 In RUSSIAN and ENGLISH
(BLL-M-23461-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 26 BLL photocopy coupons

Lake and marsh water level variations from the 18th to the 20th centuries are presented. Water levels are shown to change every 25 to 45 years, from drought and refilling. J.R.T.

N75-28640 British Library Lending Div., Boston Spa (England).
AN ACCOUNT OF LONG-TERM TENDENCIES IN THE CHANGE IN ATMOSPHERIC AND HYDROSPHERIC CHARACTERISTICS IN DEVELOPING METHODS OF LONG-RANGE HYDROMETEOROLOGICAL FORECASTS, AND IN COMPILING THEM
A. A. Girs [1974] 12 p refs Transl. into ENGLISH from Glav. Uprav. Sluz. (USSR), v. 2, 1972 p 140-148 Presented at 5th All-Union Met. Conf.
(BLL-M-23533-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Large-scale atmospheric processes in circulation are discussed which last from 10 to 30 years. The four such epochs which have occurred in the past 70 years (1900-1969) were studied; an epoch is defined as a period of time during which the frequency of processes of one (or two) forms is systematically (from year to year) above the norm, while processes of the other forms are weakened (their frequency being systematically below the norm). M.J.S.

N75-28641 British Library Lending Div., Boston Spa (England).
THE PROBLEM OF FORECASTING CLIMATIC FLUCTUATIONS
O. A. Drozdov and T. V. Pokrovskaja [1974] 15 p refs Transl. into ENGLISH from proceedings of 5th All-Union Met. Conf. (Leningrad), v. 3, 1972 p 17-26 Presented at the 5th All-Union Met. Conf.
(BLL-M-23532-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Various types of climatic fluctuations are discussed along with the length of their cycles. Cycles with a period of from 3 to 22 years are found to be the steadiest in maintaining a mean period of fluctuation. Secular cycles (lasting 80 to 100 years) in fluctuations of temperature, precipitation, and ice cover are genetically connected: variations in ice cover, taken together with their causative factors, are a reliable basis for forecasting temperature and precipitation several decades ahead. The effects of solar and volcanic activity are also considered. M.J.S.

N75-28642 British Library Lending Div., Boston Spa (England).
HOW THE LIFE SPAN OF THE SUMMER STRATOSPHERIC ANTICYCLONE AFFECTS THE WEATHER IN SUCCEEDING MONTHS
D. A. Ped and L. M. Rudiceva [1974] 14 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 122, 1973 p 66-73 In ENGLISH and RUSSIAN
(BLL-M-23618-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

Using variation coefficients it was found that the relative variability of the summer type of circulation is higher than that of the winter type. This means that fluctuation in the duration of the summer type has a greater effect on the general circulation and on the formation of the ensuing weather. Results of the investigation are presented and discussed. M.J.S.

N75-28643 British Library Lending Div., Boston Spa (England).
FORECASTING THE MEAN MONTHLY H500 FIELDS IN THE NORTHERN HEMISPHERE FOR DECEMBER, JANUARY AND FEBRUARY WITH THE AID OF ANALOGUES
G. I. Turkenic [1974] 7 p refs Transl. into ENGLISH from Gidromet. Nauchn. Issled. Cent. SSSR (Leningrad), v. 92, 1972 p 106-110
(BLL-M-23553-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The influence was investigated of the mean monthly 500 mb level fields in the Northern Hemisphere in preceding months on their formation in succeeding months. Estimation of this influence

was made using computer-selected analogs, and some results are presented. M.J.S.

N75-28644 British Library Lending Div., Boston Spa (England).
SEASONAL PRECIPITATION FORECASTING
I. E. Cuvasina [1974] 8 p refs Transl. into ENGLISH from Gl. Geof. Obs., T. Vyp. (USSR), v. 273, 1972 p 113-115
(BLL-M-23408-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

April-June precipitation forecasts from 1946 to 1969 are described compiling a forecast for 1970. The expansion coefficients are computed using vectors obtained by expanding the fields of monthly precipitation. The values of seasonal precipitation for 1970 are shown. M.C.F.

N75-28645 British Library Lending Div., Boston Spa (England).
Z/R RELATIONS AND WEATHER SITUATIONS AT HOHENPEISSENBERG
Rudolf Aniol [1974] 11 p refs Transl. into ENGLISH from Meteorol. Rdsch. (West Germany), v. 27, no. 1, Apr. 1074 p 27-29 In ENGLISH and GERMAN
(BLL-M-23634-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The relations between radar reflectivity and precipitation were investigated, with the weather situation being taken into consideration. Topics discussed include raindrop spectrum, amounts of precipitation, and wind speeds. M.J.S.

N75-28646*+ Old Dominion Univ., Norfolk, Va.
LASER APPLICATIONS TO ATMOSPHERIC SCIENCES: A BIBLIOGRAPHY
Franklin S. Harris, Jr. Washington NASA Jun. 1975 134 p refs
(Grant NGR-47-003-068)
(NASA-CR-2536) Avail: NTIS HC $5.75 CSCL 04B

A bibliography is given of 1460 references of the applications of lasers to atmospheric sciences. The subjects covered include: aerosols; clouds; the distribution and motion of atmospheric natural and man-made constituents; winds; temperature; turbulence; scintillation; elastic, Raman and resonance scattering; fluorescence; absorption and transmission; the application of the Doppler effect and visibility. Instrumentation, in particular lidar, is included, also data handling, and interpretation of the data for meteorologikal processes. Communications, geodesy and rangefinding are not included as distinct areas. The application to the atmosphere is covered, but not the ocean or its surface. Author

N75-28647 British Library Lending Div., Boston Spa (England).
ON THE TIME STRUCTURE OF TEMPERATURE SERIES
N. A. Lepehina and E. I. Fedorcenko [1974] 12 p refs Transl. into ENGLISH from Glav. Geof. Obs., T. Vyp. (Leningrad), no. 286, 1972 p 63-70
(BLL-M-Trans-23455-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

A method is reported for calculating the correlation coefficients for the mean diurnal temperature using data on the sub-diurnal temperature variability. Verification of this method on observations made at the hydrometeorological station at SURGUT gave satisfactory results. Some data on the time structure of extreme and current temperatures are also given. Author

N75-28648*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSSIBLE RAINFALL REDUCTION THROUGH REDUCED SURFACE TEMPERATURES DUE TO OVERGRAZING
J. Otterman (Tel-Aviv Univ.) Jun. 1975 49 p refs Submitted for publication
(NASA-TM-X-70927; X-910-75-93) Avail: NTIS HC $3.75 CSCL 04B

Surface temperature reduction in terrain denuded of vegetation (as by overgrazing) is postulated to decrease air convection, reducing cloudiness and rainfall probability during weak meteorological disturbances. By reducing land-sea daytime temperature differences, the surface temperature reduction decreases daytime circulation of thermally driven local winds. The described desertification mechanism, even when limited to arid regions, high albedo soils, and weak meteorological disturbances, can be an effective rainfall reducing process in many areas including most of the Mediterranean lands. Author

N75-28649# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A PHOTORECONNAISSANCE TECHNIQUE FOR CONDUCTING TIME-LAPSE STUDIES OF THE DEVELOPMENT AND MOTIONS OF CUMULUS CLOUD POPULATIONS AND SYSTEMS Environmental Research Papers
Vernon G. Plank 4 Jun. 1974 69 p refs
(AF Proj. 8620)
(AD-A005388; AFCRL-ERP-478; AFCRL-TR-74-0250) Avail: NTIS CSCL 04/2

Tests of the technique were conducted over the Florida peninsula on four days in October 1965 using a U-2 aircraft that was flown continuously in a circle on autopilot at 66,000 ft altitude for sortie duration periods of 3 to 4 hr. Each circle was completed in approximately 4 min time. Photographs taken with a radial scan-type camera were acquired from numerous, equally-spaced points around the circles and were used to construct mosaic disks, one for each circle, which provided a photographic record of the underlying cloud coverage throughout 360 degrees of azimuth angle, from horizon to horizon. The time series of mosaics revealed the spatial, temporal, and motion events that occurred within the fields of cumulus activity. The errors and uncertainties of the technique which were indicated by the tests are discussed. Examples are presented of the data acquired on the four test days and of their relation to conventional weather map, satellite, and radar information. GRA

N75-28650# Army Electronics Command, Fort Monmouth, N.J.
THE EFFECT OF ATMOSPHERIC CO2 VARIATIONS ON SATELLITE SOUNDED TEMPERATURES
Rufus E. Bruce and Louis D. Duncan Dec. 1974 19 p refs
(DA Proj. 1T1-62111-AH-71-A267)
(AD-A005573; ECOM-5552) Avail: NTIS

An analysis was made of the Satellite Temperature Sounding Technique to determine the extent of temperature errors arising from possible atmospheric CO2 variations. These possible errors are compared to probable ozone-caused errors and to errors resulting from the radiometer uncertainties. GRA

N75-28651# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
HYDROMETER PARAMETERS DETERMINED FROM THE RADAR DATA OF THE SAMS RAIN EROSION PROGRAM
Vernon G. Plank 4 Jun. 1974 84 p refs
(AF Proj. 8620)
(AD-A005391; AFCRL-ERP-477; AFCRL-TR-74-0249) Avail: NTIS CSCL 17/9

The traditional equations relating the radar reflectivity factor and the precipitation rate are reviewed. The hydrometeor and radar parameters involved in the AFCRL/SAMS program at Wallops Island, Virginia, are defined and the methods of measurement and correlation are explained. The hydrometeor regions and transition zones of the Wallops Island storms are discussed and the methods of computing the precipitation rate, the liquid-water-content, and the integral of the liquid-water-content along the trajectories of the SAMS missiles fired into the storms are demonstrated. A case example is presented to illustrate the details of the computational procedures. The uncertainties of the liquid-water-content values determined from radar measurements are assessed, to a first approximation. Size distribution information is also presented for the different types of hydrometeors, based on theoretical distribution functions. GRA

N75-28652# Maryland Univ., College Park. Computer Science Center.
AUTOMATIC WIND VELOCITY ESTIMATION FROM MULTI-SPECTRAL GEOSYNCHRONOUS SATELLITE DATA, A PROPOSAL Interim Report
Jo Ann Parikh Sep. 1974 124 p refs
(Contract F44620-72-C-0062; AF Proj. 9769)
(AD-A005695; TR-328; AFOSR-75-0244TR) Avail: NTIS CSCL 04/2

The report presents a survey of manual and automatic procedures for cloud type classification, as well as for cloud

motion estimation from satellite data and from data received at local weather-observing stations. A system for automatic determination of wind velocity over the tropical oceans for clouds at low and high levels is proposed. GRA

N75-28653# Army Electronics Command, Fort Monmouth, N.J.
OPERATIONAL TECHNIQUES FOR RADAR SET AN/TPS-41
Walter Conover Nov. 1974 52 p refs
(DA Proj. 1T0-62111-A-126)
(AD-A005010; ECOM-5549) Avail: NTIS CSCL 04/2

The report provides techniques for use with the mobile Weather Radar Set AN/TPS-41. The techniques will permit the meteorologically untrained radar operator to interpret the radar signal in terms of weather parameters and to communicate the weather information. Since the radar set is intended to be moved on occasion, particular attention is given to the problems of siting the radar at new locations. The means for obtaining an optimum return signal is discussed. A simplified description of types of rainfall to be observed is given. A method is presented for calculating rainfall rate by a nomogram. Techniques are described for interpreting echoes in terms of rainfall intensity and presenting the resultant information to the user. GRA

N75-28654# Naval Research Lab., Washington, D.C.
WATER VAPOR MEASUREMENTS OVER THE EASTERN PACIFIC OCEAN AT THE 180 MILLIBAR PRESSURE LEVEL Final Report
Henry J. Mastenbrook 22 Jan. 1975 12 p refs
(Contract DOT-AS-30065; NRL Proj. A03-09)
(AD-A005396; NRL-7849) Avail: NTIS CSCL 04/2

A frost-point hygrometer has been installed on the NASA C141 Flying Observatory to measure water vapor in the upper troposphere and lower stratosphere. Measurements were made during two flights in June 1974 in the region of the subtropical high-pressure cell over the eastern Pacific Ocean at an upper tropospheric pressure height of 180 mb. The relative humidity in the region was found to be high, implying that the subsidence characterizing the lower tropospheric level of the subtropical high is weak or nonexistent at the 180-mb level in early summer. Saturation of the level at times due to vertical oscillations seems likely. GRA

N75-28655# National Oceanic and Atmospheric Administration, Boulder, Colo. Wave Propagation Lab.
THE NOAA PASSIVE OPTICAL CROSSWIND MONITOR
G. R. Ochs, G. F. Miller, and E. J. Goldenstein Sep. 1974 25 p refs
(COM-75-10355/6; NOAA-TM-ERL-WPL-11; NOAA-75030302; ECOM-74-2) Avail: NTIS HC $3.25 CSCL 04B

An optical instrument that measures crosswinds by observing the scintillation of naturally illuminated scenes is described. Operating instructions, adjustment procedures, and circuit diagrams are included. GRA

N75-28656# National Oceanic and Atmospheric Administration, Washington, D.C. Federal Coordinator for Meteorological Services and Supporting Research.
NATIONAL SEVERE LOCAL STORMS OPERATIONS PLAN
Feb. 1975 61 p refs
(COM-75-10388/7; FCM-75-1; NOAA-75030601) Avail: NTIS HC $4.25 CSCL 04B

The responsibilities of the various United States agencies which provide meteorological services in observing and forecasting severe local storms are outlined in this report. Common meteorological terms, subject to multiple interpretations, which are presented along with common criteria and differences in the issuance of forecasts and warnings. The various communications and radar networks are outlined. GRA

N75-28657# Naval Weather Service Environmental Detachment, Asheville N.C.
GUIDE TO STANDARD WEATHER SUMMARIES AND CLIMATIC SERVICES
Jan. 1975 205 p
(AD-A004986) Avail: NTIS CSCL 04/2

The publication provides a description of published and unpublished climatological summaries available from the National Climatic Center. It also includes a catalogue of the available summaries on a world-wide basis in continent-country-station order. GRA

N75-28658# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SUMMER CLIMATE AT SELECTED SITES ON THE ROSS ICE SHELF AND THE GREENLAND ICE SHEET
M. A. Bilello and R. E. Bates Oct. 1975 22 p refs
(Grant NSF AG-394)
(AD-A005034; CRREL-SR-216) Avail: NTIS CSCL 04/2

Climatic summaries for several sites on the Ross Ice Shelf, Antarctica, and selected locations on the Greenland ice sheet were analyzed to determine the type of weather that can be expected in these areas during the summer months. Daily minimum and maximum air temperatures of from 0 to 25F are estimated to occur near 82.5 degrees S and 166 degrees W during December, January and February on the Ross Ice Shelf. Snowfall in summer is relatively infrequent and total amounts generally light, so that extended periods of good flying weather can be expected in summer. However, intervals of poor weather, including heavy snow, fog, whiteout and strong winds with drifting and blowing snow can occur each summer. Average minimum and maximum air temperatures during June, July and August range from 8F to above freezing in the southern portion of the Greenland ice sheet and from -9 to 17F near the summit. Stations east of the crest record light winds from the north and northeast, and those west of the crest stronger winds from the east. Winds near South Site at 63 degrees N in mid-summer are predicted to be generally westerly and to average 9 to 10 mph. Snowfall and fog also apparently occur more frequently in the southern region of the ice sheet. Although good flying weather can be expected during much of the summer near the summit, intervals of snow, fog, whiteout or strong winds with drifting or blowing snow can occur. GRA

N75-28659# Army Electronics Command, Fort Monmouth, N.J.
SOME BEHAVIOR CHARACTERISTICS OF THE RAWINSONDE AND AN/FPS-16 RADAR WHEN USED AS BALLOON TRACKING DEVICES
Edward M. DArcy Jan. 1975 29 p refs
(AD-A005011; ECOM-5555) Avail: NTIS CSCL 04/2

Nine balloon flights were made in which the balloon was tracked simultaneously by a GMD-1B and an FPS-16 radar. In seven of the flights two FPS-16s were used simultaneously with the GMD. Results obtained from these flights were examined in light of error models of these systems. Results were also examined as to their effects when applied to unguided rocket impact prediction. In agreement with theory the FPS-16 is shown to be a very accurate wind measuring system under all wind conditions while the GMD produces unrealistic profiles at the higher wind speeds. It is also shown that large dispersions in the predicted impact of unguided rockets can occur if the GMD is used to measure the wind profile used in the prediction. GRA

48 OCEANOGRAPHY

Includes biological, dynamic and physical oceanography; and marine resources.

N75-28660*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DUAL FREQUENCY SCATTEROMETER MEASUREMENT OF OCEAN WAVE HEIGHT
J. W. Johnson, W. L. Jones, C. T. Swift, W. L. Grantham, and D. E. Weissman 8 Jul. 1975 23 p ref Presented at 1974 USNC/URSI Meeting, Boulder, Colo., 14-17 Oct. 1974
(NASA-TM-X-72752) Avail: NTIS HC $3.25 CSCL 08C

A technique for remotely measuring wave height averaged over an area of the sea surface was developed and verified with a series of aircraft flight experiments. The measurement concept involves the cross correlation of the amplitude fluctuations of two monochromatic reflected signals with variable frequency separation. The signal reflected by the randomly distributed

specular points on the surface is observed in the backscatter direction at nadir incidence angle. The measured correlation coefficient is equal to the square of the magnitude of the characteristic function of the specular point height from which RMS wave height can be determined. The flight scatterometer operates at 13.9 GHz and 13.9 - delta f GHz with a maximum delta f of 40 MHz. Measurements were conducted for low and moderate sea states at altitudes of 2, 5, and 10 thousand feet. The experimental results agree with the predicted decorrelation with frequency separation and with off-nadir incidence angle.
Author

N75-28661# National Oceanic and Atmospheric Administration, Boulder, Colo. Marine Ecosystems Analysis Program.
SUMMARY AND ANALYSIS OF PHYSICAL OCEANOGRAPHY DATA COLLECTED IN THE NEW YORK BIGHT APEX DURING 1969 - 1970
R. L. Charnell and D. V. Hansen Aug. 1974 49 p refs
(COM-75-10358/0; MESA-74-3; NOAA-75030303) Avail: NTIS; SOD HC CSCL 08C

The report presents an analysis of physical oceanography data collected on a monthly basis in the apex of the New York Bight during 1969 and early 1970. Data include temperature and salinity values, recovery information on surface and seabed drifters, and current meter observations. Hudson River discharge and wind data from Ambrose light station are also included. The data show apex water to be stratified three-fourths of the year caused by high river runoff and insolation. During winter, heat loss and wind mixing destroy and impede reformation of stratification. There is a strong northward flow of water in the lower layers along the axis of the Hudson shelf channel. GRA

N75-28662# Compass Systems, Inc., San Diego, Calif.
PROGRAM COATEM Final Report
Baldwin VanDerBijl Sep. 1974 18 p
(Contract N62271-73-M-1022)
(AD-A005310; Rept-156-15; EPRF-CP-Note-15) Avail: NTIS CSCL 08/10

The report describes CDC 1604 FORTRAN tape-to-tape utility routine for conversion from BAUER's DEEP SEA DATA format to COAT format compatible with the ANATRY programs. It was developed as an adjunct to a requirement for numerical analysis of Mediterranean salinity and temperature climatology.
GRA

N75-28663# Washington Univ., Seattle. Dept. of Oceanography.
ATLANTIC WATER CIRCULATION IN THE CANADA BASIN
J. L. Newton and L. K. Coachman Dec. 1974 16 p refs
(Contract N00014-67-A-0103-0021; NR Proj. 307-326)
(AD-A005379; TR-9) Avail: NTIS CSCL 08/3

Within the Canada Basin of the Arctic Ocean, water of Atlantic origin occupies the depths between 300 and 900 m. This water is characterized by a temperature maximum of +0.5 to +0.6C usually at about 500 m, and has salinities in the range 34.85 to 34.95 parts per thousand by weight. Atlantic water initially enters the Arctic Ocean east of Greenland at a temperature = 3.0C and salinity of about 35.00 parts per thousand by weight. It then moves across the Lomonosov Ridge north of Siberia, and flows east along the East Siberian shelf, apparently entering the Canada Basin north of the Chukchi Plateau. The circulation within the Canada Basin is anticyclonic, like the surface flow. This note presents the results of a re-examination of the Atlantic water flow in the Canada Basin. GRA

N75-28664# Informatics, Inc., Rockville, Md.
BIBLIOGRAPHY OF SOVIET MATERIAL ON INTERNAL WAVES, APRIL - DECEMBER 1974
Stuart G. Hibben and Lee H. Boylan 27 Jan. 1975 30 p refs
(Contract N00600-75-C-0018; DARPA Order 2790)
(AD-A005565) Avail: NTIS CSCL 08/3

The report is the third bibliography of Soviet open-source publications relating to internal wave studies. It covers material received from May through December 1974. Main selection criteria are studies of small-scale variation in ocean parameters and of airborne techniques for deducing internal wave conditions. An index of serial source abbreviations is appended. GRA

N75-28665# Compass Systems, Inc., San Diego, Calif.
PROGRAM ROGMAP Final Report
Roger Bauer and Baldwin VanDerBijl Sep. 1974 22 p refs
(Contract N62271-73-M-1271)
(AD-A005312; EPRF-CP-Note-17; Rept-166-17) Avail: NTIS CSCL 08/3

The report describes a CDC 6500 FORTRAN program ROGMAP and its associated subroutines which provide CALCOMP contour plots of water height or concentration fields generated by the EPRF Hydrodrodynamic Numerical (HN) Model. ROGMAP is a modification of program WATEHTC and was prepared as an adjunct to a requirement to provide effective data displays of HN Model raw data. GRA

N75-28666# Hydronautics, Inc., Laurel, Md.
SURFACE EFFECTS: AN ANALYSIS AND REVIEW OF THE PROCESSES INVOLVED AND PHENOMENA OBSERVED
O. M. Phillips Dec. 1974 99 p refs
(Contract N00014-72-C-0509; NR Proj. 062-472)
(AD-A004956; TR-7211-9) Avail: NTIS CSCL 08/3

This report analyzes and reviews the processes involved in the generation of modulations in short wave structure by internal waves. The emphasis is on field conditions where, in general, there is wind blowing, a mean current with vertical structure, long and short waves at different directions to the internal wave and possibly surface films. The applicability or otherwise of theoretical analyses and laboratory experiments to field situations is discussed, the problem being the variety of interacting phenomena found under natural conditions. Chapter headings are the following: Mean velocity structure above the thermocline; The variations in surface velocity resulting from internal waves; Surface films; Energy modulations in a surface wave train produced by direct interaction; Wave breaking. GRA

N75-28667# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
EFFECTS OF A STEADY NONUNIFORM CURRENT ON THE CHARACTERISTICS OF SURFACE GRAVITY WAVES Final Report
Lyndell Z. Hales and John B. Herbich Dec. 1974 190 p refs
(AD-A005005; AEWES-Misc-Paper-H-74-11) Avail: NTIS CSCL 08/3

The effects of flood and ebb tidal currents on incoming surface gravity wave trains were investigated in a three-dimensional wave basin. An existing facility was altered to provide a configuration which simulated an estuary with an inlet through which were passed monochromatic waves of known characteristics. Steady, nonuniform currents, both with and against the incoming waves, were created and the characteristics of the wave trains were determined after encountering the currents. The basic objectives of this study were: (a) to investigate the effect of tidal currents on the period or frequency and on the distribution of energy in the frequency spectrum; (b) to quantitatively determine the changes which occur to the wave heights and lengths in the inlet proper; (c) to better understand the breaking phenomena occurring in the ocean region under ebb currents; (d) to evaluate the effect on energy propagation through the inlet; and (e) to determine the applicability of the existing theoretical work in the area. GRA

N75-28668# Nova Univ., Dania, Fla. Physical Oceanographic Lab.
NUMERICAL MODEL FOR PREDICTION OF SURFACE CURRENTS IN THE OCEAN
Mark Goldstein (Intern. Business and Res., Inc., Coral Gables, Fla.) and Peter Niiler May 1974 171 p refs
(Contract DOT-CG-40056-A)
(AD-A005054; USCG-D-40-75; CGR/DC-28/74) Avail: NTIS CSCL 08/3

An ensemble of 136 observations of surface currents on the western Florida Shelf near 82 deg 30 min W, 25 deg 30 min N is reported. The method uses aerial photography of the position of a fixed and a freely floating dye marker. A least-square estimate of the offshore tidal currents is made from this ensemble, and Pollard's (1971) model of wind-driven currents

is used to estimate the residual wind-driven flow. The projected vector diagrams of the surface wind and the total currents are computed for October and November of 1971. The principal conclusions are: (a) It is observed that there exists a lateral coherence of currents in a 16-km radius on the shelf; (b) no persistent current is predicted or observed over this two-month period, and the projected vector diagrams form an ensemble of closed loops. Implications for the drift of objects and pollutants on the shelf are discussed. GRA

N75-28669# University of South Florida, Tampa.
SIMULATANEOUS PROCESS-RESPONSE STUDY ON THE EAST AND WEST COASTS OF LAKE MICHIGAN
Richard A. Davis, Jr. and William T. Fox (Williams Coll., Williamstown, Mass.) 31 Dec. 1974 70 p refs
(Contracts N00014-69-C-0151; NR Proj. 388-092)
(AD-A005647; TR-13) Avail: NTIS CSCL 13/2

A 15-day time-series study was conducted simultaneously on both the east and west sides of Lake Michigan during the summer of 1974. Sites at Zion, IL and South Haven, MI were investigated following the same procedures as used during previous Lake Michigan studies. Primary objective of the study was to determine the nature of process-response activities as a single weather system moves offshore and onshore as it crosses the lake. Only one low pressure system passed over the study area during the period of investigation. Observed patterns in the weather, waves and currents are quite similar at both sites and are similar to patterns from previous studies. In general energy is higher on the east side (onshore) as compared to the west side (offshore). The low intensity of the passing weather system was reflected in the small amount of change to the beach and nearshore morphology. Increasing energy caused erosion to the strand area and deposition in the plunge zone. During maximum energy conditions the plunge zone was eroded and deposition took place on the foreshore. GRA

51 LIFE SCIENCES (GENERAL)

Includes genetics.

N75-28670 Virginia Polytechnic Inst. and State Univ., Blacksburg.
THE EFFECT OF HIGH PURITY OXYGEN ON THE ACTIVATED SLEDGE PROCESS Ph.D. Thesis
Larry David Benefield 1975 208 p
Avail: Univ. Microfilms Order No. 75-15866

The effect of using high purity oxygen as the gas of aeration on the activated sludge process is investigated. The gas of aeration was high purity oxygen and compressed air. A soluble composition of nutrient broth, glucose, yeast extract, and various mineral salts was used as the substrate. Sludge age was used as the control parameter and control was achieved by wasting a specific volume of sludge each day. Results indicated that (1) an activated sludge system operating at low solids and high dissolved oxygen concentration is susceptible to takeover by filamentous microorganisms; (2) it is not the use of oxygen which is responsible for differences in substrate removal rates and yield observed between air and oxygen activated sludge units. Such differences are probably the result of the high solids levels at which most oxygenation systems operate; and (3) activated sludge systems, when operated under either air or oxygen aeration, will show no significant variation in the gross composition of microbial mass. Dissert. Abstr.

N75-28671 Maryland Univ., College Park.
SYNTHESIS OF OPTIMAL PROGRAMMABLE CONTROL POLICIES FOR LUMPED AND DISTRIBUTED PARAMETER REACTOR SYSTEMS Ph.D. Thesis
Francis Mary Deane 1974 372 p
Avail: Univ. Microfilms Order No. 75-15771

Optimal programmable control policies for various reactor systems were synthesized via Pontryagins Maximum Principle. Optimal programmable temperature and pH policies were calculated for the enzymatic hydrolysis of Penicillin G. In a cyclically operated reactor, optimal periodic control for temperature, pH, inlet flow rate and inlet feed rate concentration was also synthesized. Optimal bifunctional catalyst composition profiles for a three stage catalytic reformer were synthesized for both isothermal and adiabatic operation. For the liquid phase isomerization of xylene, occurring over a zeolite catalyst subject to temperature dependent deactivation, optimal temperature policies were synthesized based on bed position and catalyst age. The policies increased yields 20-30% above those obtained at the optimum constant temperature. Finally, optimal temperature policies were synthesized for a generalized second order reaction when the catalyst is subject to both temperature and concentration dependent deactivation. Dissert. Abstr.

N75-28672# Joint Publications Research Service, Arlington, Va.
SPACE BIOLOGY AND AEROSPACE MEDICINE, VOLUME 9, NO. 3, 1975
O. G. Gazenko, ed. 24 Jul. 1975 147 p refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 3-88
(JPRS-65301) Avail: NTIS HC $5.75

The effects of space flight stress on physiological responses of humans, animals, and plants are studied. For individual titles, see N75-28673 through N75-28692.

N75-28673 Joint Publications Research Service, Arlington, Va.
AEROSPACE MEDICINE: ON THE THIRTIETH ANNIVERSARY OF THE VICTORY OF THE SOVIET PEOPLE IN THE GREAT FATHERLAND WAR c52
N. M. Rudnyy *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 1-7 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 3-7 (For availability see N75-28672 19-51)

The history of aerospace medicine is outlined for its formation in 1920 up to the present time. Achievements in research and development for aviation and astronautics are briefly described. G.G.

N75-28674 Joint Publications Research Service, Arlington, Va.
EXPERIMENT WITH A PHYSIOLOGICALLY ACTIVE CHLORELLA CULTURE ON THE SOYUZ-9 SPACESHIP c54
E. V. Moskvitin and E. N. Vaulina *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 8-13 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 7-10 (For availability see N75-28672 19-51)

A physiologically active culture of Chlorella was exposed for the first time aboard the Soyuz 9 spacecraft. The use of a special front element container made it possible in a single experiment to investigate the effect of spaceflight factors on the cells of algae developing under illumination conditions during the first, sixth and fourteenth days. In addition, the effect of flight conditions was studied with respect to a Chlorella culture. It was found that there is an insignificant change in sensitivity of the cells to the effect of flight factors, depending on the duration of their exposure in an active state. Author

N75-28675 Joint Publications Research Service, Arlington, Va.
INFLUENCE OF ELECTROCHEMICAL FACTORS ON CULTIVATION OF HYDROGENOMONAS EUTROPHA Z-1 IN AN ELECTROLYTIC CELL
O. S. Ksenzhek, V. M. Serebritskiy, and V. V. Vecherova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 14-19 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 11-14 (For availability see N75-28672 19-51)

The effect of electrode processes on the cultivation of Hydrogenomonas eutropha Z-1 combined with electrolysis of the nutrient medium was studied. The phenomena occurring at the anode under different conditions of mixing and electrolysis were examined. The possibilities of eliminating adverse effects at the anode were determined. The behavior of the trace elements precipitating at the cathode and the conditions of their dissolving were investigated. Author

N75-28676 Joint Publications Research Service, Arlington, Va.
CHANGES IN SOME PHYSIOLOGICAL INDICES IN WHITE RATS UNDER THE INFLUENCE OF ACCELERATIONS UP TO 24 HOURS

V. L. Popkov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 20-24 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 14-17 (For availability see N75-28672 19-51)

The physiological effects of prolonged accelerations of 2 and 4 g applied longitudinally and transversely to the long axis of the body of white rats were studied. The animals exposed to accelerations for 24 hours exhibited a decrease in the heart rate, respiration rate, rectal temperature, PO2 and pCO2 in the peripheral tissues. Author

N75-28677 Joint Publications Research Service, Arlington, Va.
SOME AUTONOMIC REACTIONS IN RABBITS EXPOSED TO A PERMANENT MAGNETIC FIELD
L. D. Klimovskaya and N. P. Smirnova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 25-32 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 18-22 (For availability see N75-28672 19-51)

Chronic experiments with rabbits have shown that their exposure to a permanent magnetic field of 4,500 oe for three hours causes a transient hypotension, a decrease in the respiratory rate and a tendency to bradycardia. Immediately after the exposure the pressor reaction and bradycardia level decrease but by the end of the first day they increase. At this time the respiration rate increases in response to the administration of epinephrine, acetyl choline or stimulation of the midbrain reticular formation. The exposure does not decrease the compensatory possibilities of the cardiovascular and respiratory systems. This follows from their reactions to accelerations of 6 and 10 g. Author

N75-28678 Joint Publications Research Service, Arlington, Va.
COMPARATIVE CHARACTERISTICS OF POLY- AND MONOMER PROTEIN NUTRITION AS APPLICABLE TO SPACE FLIGHTS **c54**
V. G. Vysotskiy *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 33-41 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 23-28 (For availability see N75-28672 19-51)

The use of pure protein mono- and polymers for human nutrition was studied in a 45 day experiment in which 12 test subjects participated. The first group of six persons was given casein and the second group an equivalent mixture made of crystalline L-amino acids. The first group exhibited no abnormalities in physiological and biochemical functions. The second group exhibited marked changes in the body: weight losses, negative nitrogen balance, increase in the ammonia concentration in the urine and exhaled air. It appears that amino acid mixtures can be included in human nutrition only after extensive studies.
Author

N75-28679 Joint Publications Research Service, Arlington, Va.
MODEL OF THE TRANSPORT OF GASES IN PERIODICALLY VENTILATED LUNGS **c52**
V. G. Shabelnikov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 42-49 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 28-34 (For availability see N75-28672 19-51)

Gas transport in the lungs was studied by mathematical modeling of the effect of discrete pulmonary ventilation, that is, alternation of inhalation and exhalation. A qualitative analysis of a system of differential equations describing changes in the composition of air in the alveoli during the breathing cycle demonstrated that at least twice in each respiratory cycle the alveolar air had the ideal composition predicted by the normally continuously ventilated model of the lungs. The result pointed to the sum total of possible values of the air composition at different sites of nonuniformly functioning lungs. This lung model takes into account the effect of volume concentration of the inert gas in the breathing mixture and the high solubility of CO2 in the blood and pulmonary tissues on pulmonary gas exchange. Author

N75-28680 Joint Publications Research Service, Arlington, Va.
SOME THEORETICAL ASPECTS OF CONSTRUCTING MEDICAL MONITORING SYSTEMS IN SPACE FLIGHTS **c54**
N. N. Gurovskiy and A. D. Yegorov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 50-54 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 34-37 (For availability see N75-28672 19-51)

Theoretical approaches to a medical monitoring system during prolonged space flights are presented by classifying the most probable states occurring during long term weightlessness. The main symptoms of these states are described. On the basis of this classification the methods and parameters to be used in diagnosis of the symptoms which may occur in space flights are discussed. Author.

N75-28681 Joint Publications Research Service, Arlington, Va.
USE OF LENGTHENED AND SHORTENED DAYS ON SPACE FLIGHTS **c53**
S. I. Stepanova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 55-70 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 37-48 (For availability see N75-28672 19-51)

On the basis of experimental findings and data in the literature it is concluded that a 24-hour day should be recommended for space missions. It is assumed that in the future lengthened or shortened days may be used. This is confirmed by the hypothesis that the information energy cost of the diurnal cycle is constant. Author

N75-28682 Joint Publications Research Service, Arlington, Va.
HYPOBARIC NITROGEN-OXYGEN ATMOSPHERE AS A METHOD FOR PREVENTING HIGH-ALTITUDE DECOMPRESSION DISEASE **c52**
A. M. Genin, I. N. Chernyakov, I. V. Maksimov, and V. A. Glazkova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 71-76 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 48-52 (For availability see N75-28672 19-51)

It has been demonstrated experimentally that the development of altitude decompression disease at 250 and 180 mm Hg can be prevented by preliminary desaturation in a nitrogen oxygen hypobaric atmosphere (60% N2 and 40% O2 at 550 mm Hg). This has been demonstrated in 38 experiments with 21 test subjects. The use of this atmosphere in space cabins prevents the development of decompression disease upon a decrease in cabin pressure to 250 mm Hg and during activity in a space suit with 180-200 mm Hg outside the ship. Author

N75-28683 Joint Publications Research Service, Arlington, Va.
EFFECT EXERTED ON THE HUMAN AND ANIMAL BODY BY REPEATED EXPOSURE IN A RAREFIED ATMOSPHERE
V. G. Petrukhin, V. G. Terentyev, and I. N. Chernyakov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 77-82 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 53-56 (For availability see N75-28672 19-51)

In order to study the chronic form of decompression disease, clinical and physiological examinations of 38 test subjects were carried out. They participated in 133 chamber experiments and were exposed to an altitude of 11,000 to 12,000 m for 2 to 3 to 20 to 24 hours after desaturation of different duration. In addition, histological and histochemical examinations of organs and tissues of three dogs were performed. During 70, 110 and 140 days the dogs were exposed 20, 33 and 35 times to an altitude of 12,000 m for 2-2.5 hours without preliminary desaturation. No persistent pathological changes were found in the animal or human body. Author

N75-28684 Joint Publications Research Service, Arlington, Va.
CHANGES IN INDICES OF THE BLOOD COAGULATING AND ANTICOAGULATING SYSTEM IN FLIGHT CREWS UNDER THE INFLUENCE OF FLIGHT FACTORS **c52**
Ye. S. Nodova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 83-88 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 56-60 (For availability see N75-28672 19-51)

A total of 105 flight qualified crew members in the age group 20 to 40 years were under observation. Coagulographic and thromboelastographic parameters of the venous blood were studied. The most significant changes (an increase in the coagulation time as related to the time of plasma recalcification, a decrease in plasma tolerance to heparin, R, K, R + K, a decrease in the coagulation index Si with respect to the thromboelastogram, a significant increase in the fibrinolytic activity and the heparin number) were noted during the postflight period in commanders, pilots and navigators. Less significant variations in the coagulographic parameters were observed in other crew members. These changes can be regarded as the protective-reactive reaction of the anticoagulatory system aimed at reducing hypercoagulation during the emotional stress effect of the flight. Author

N75-28685 Joint Publications Research Service, Arlington, Va.
CHANGE IN ASYMMETRY OF SOME PAIRED FUNCTIONS IN AIRMEN UNDER THE INFLUENCE OF FLIGHT FACTORS **c52**
V. A. Yegorov and V. K. Shirogorov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 89-95 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 60-64 (For availability see N75-28672 19-51)

The flight activity of a pilot brings about peculiar changes in the asymmetry of physiological functions whose pattern is dependent to a large extent on the initial state of asymmetry. An in-flight change in the functional state and the interaction of paired structures of the cerebral hemispheres results in a reduction in the predominance of the guiding arm in pilots with distinct preflight asymmetry and an increase in opposite asymmetric fluctuations in pilots with insignificant preflight asymmetry. Author

N75-28686 Joint Publications Research Service, Arlington, Va.
PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF THE WORK ACTIVITY OF AN OPERATOR WEARING SPECIAL GEAR **c53**
V. A. Ponomarenko, R. I. Brusnichkina, and N. A. Fedorov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 96-102 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 64-68 (For availability see N75-28672 19-51)

The performance of a suited operator was studied. The experiments were carried out in a trainer consisting of a cockpit and electronic model of the plane attitude realized by an electronic analog computer. The experiments revealed that a special suit may reduce performance. The main reason for this is that under positive pressure the influx of afferent signals is impoverished due to a reduction in the proprioceptive feedback. This disturbs the interaction between the optical and motor analyzers. In order to increase the performance of a suited pilot it is necessary to ensure maintenance of the optical-proprioceptive relationship. Author

N75-28687 Joint Publications Research Service, Arlington, Va.
MAN'S TOLERANCE OF CORIOLIS ACCELERATIONS WITH LOADING OF DIFFERENT MUSCLE GROUPS **c52**
G. S. Ayzikov, M. D. Yemelyanov, and V. G. Ovechkin *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 103-111 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 69-74 (For availability see N75-28672 19-51)

The effect of an arbitrary loading of different muscle groups (shoulders, back, legs) and motor acts on the tolerance to Coriolis accelerations was investigated in 140 experiments in which 40 test subjects participated. The accelerations were accumulated and simulated by the Bryanov method. Muscle tension was accompanied by a less expressed vestibular autonomic reaction and shortening of the recovery period after the development of motion sickness symptoms. The greatest changes were observed during the performance of complex motor acts and loading of the shoulder muscles. Possible mechanisms of these effects are discussed. Author

N75-28688 Joint Publications Research Service, Arlington, Va.
METHOD FOR COMPUTING THE RADIATION DANGER FROM PROTON SOLAR FLARES **c52**
V. L. Generozov, A. V. Kolomenskiy, and V. A. Sakovich *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 112-118 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 74-78 (For availability see N75-28672 19-51)

The risk of exceeding established safe levels during manned space flight is computed by considering the stochastic nature of solar flares. A model is formulated that considers temporal distribution of flares, a flux distribution and a parameter characterizing the spectrum, as well as functional tissue dose distribution in the astronaut's body with flight duration. Results indicate that an increase in flight duration increases the isorisk total flux of protons monotonically; with an increase in flux the risk decreases rapidly. G.G.

N75-28689 Joint Publications Research Service, Arlington, Va.
METHOD FOR REGISTERING MUSCLE EFFORTS OF DOGS IN A CHRONIC EXPERIMENT
V. S. Oganov, V. G. Kozlova, A. S. Rakhmanov, and N. G. Esaulov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 119-123 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 78-81 (For availability see N75-28672 19-51)

The relative change in effort of an gastrocnemius dog muscle in a chronic experiment was studied by monitoring the strain which arises in its tendon in the process of active contraction or dilation of the muscle with an implanted converter. Registration of resulting dynamomyograms with different kinematic and dynamic parameters shows a relationship between excitation and contraction processes in the skeletal muscles. G.G.

N75-28690 Joint Publications Research Service, Arlington, Va.
EXPERIMENT WITH CHLORELLA ABOARD THE ZOND-8 AUTOMATIC STATION **c54**
E. N. Vaulina and E. V. Moskvitin *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 124-128 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 81-83 (For availability see N75-28672 19-51)

Space flight condition effects on the dynamic productivity of Chlorella during postflight cultivation are studied by considering variants without irradiation and with postflight irradiation. An insignificant lag in culture development for the preflight irradiation case was observed. Flight conditions had a negative effect on viability and mutability of unirradiated Chlorella cells; however, the differences between experiment and control were statistically unreliable. G.G.

N75-28691 Joint Publications Research Service, Arlington, Va.
CYTOPHYSIOLOGICAL CHANGES INDUCED BY SPACE-FLIGHT FACTORS IN THE SEEDS OF SOME CONIFEROUS SPECIES
I. N. Tretyakova and N. V. Gerasimenko *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 129-132 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 83-84 (For availability see N75-28672 19-51)

Space flight factors and their influence on growth processes of seeds of the genus Pinus were studied by cytological analyses using the tips of rootlets from germinated seeds. Resultant data show that growth processes became more intensive. Physicochemical changes in the ribonucleoproteins of cell structures were associated with dissociation of phosphoric acid groups. This effect reflects changes in cell metabolism in the direction of an intensification. G.G.

N75-28692 Joint Publications Research Service, Arlington, Va.
GENESIS OF VESTIBULAR-AUTONOMIC DISORDERS IN SPACEFLIGHT **c52**
I. I. Bryanov, E. I. Matsnev, and I. Ya. Yakovleva *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 133-140 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 85-88 (For availability see N75-28672 19-51)

The mechanism of vestibular autonomic disorder during space

flight is analyzed by considering a redistribution of the circulating blood volume during weightlessness and the resultant combination of hemodynamic changes, disturbances in the water mineral metabolism, and other functional shifts. It is shown that the high sensitivity of the labyrinth to hemodynamic disorders is predetermined by the peculiarities of its blood supply. G.G.

N75-28693*# Lockheed Electronics Co., Houston, Tex. Aerospace Systems Div.
ELECTRON MICROPROBE ANALYSIS PROGRAM FOR BIOLOGICAL SPECIMENS: BIOMAP
Ben F. Edwards Jan. 1972 113 p refs
(Contract NAS9-12200; Proj. 1030)
(NASA-CR-141923; Rept-1E4022) Avail: NTIS HC $5.25 CSCL 06B

BIOMAP is a Univac 1108 compatible program which facilitates the electron probe microanalysis of biological specimens. Input data are X-ray intensity data from biological samples, the X-ray intensity and composition data from a standard sample and the electron probe operating parameters. Outputs are estimates of the weight percentages of the analyzed elements, the distribution of these estimates for sets of red blood cells and the probabilities for correlation between elemental concentrations. An optional feature statistically estimates the X-ray intensity and residual background of a principal standard relative to a series of standards. Author

N75-28694*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SPACE STATION INTERIOR DESIGN: RESULTS OF THE NASA/AIA SPACE STATION INTERIOR NATIONAL DESIGN COMPETITION
Richard F. Haines Washington Jul. 1975 135 p refs
(NASA-TN-D-8018; A-5867) Avail: NTIS HC $5.75 CSCL 22B

The results of the NASA/AIA space station interior national design competition held during 1971 are presented in order to make available to those who work in the architectural, engineering, and interior design fields the results of this design activity in which the interiors of several space shuttle size modules were designed for optimal habitability. Each design entry also includes a final configuration of all modules into a complete space station. A brief history of the competition is presented with the competition guidelines and constraints. The first place award entry is presented in detail, and specific features from other selected designs are discussed. This is followed by a discussion of how some of these design features might be applied to terrestrial as well as space situations. Author

52 AEROSPACE MEDICINE

Includes physiological factors, biological effects of radiation; and weightlessness.

N75-28695+ Salpetriere Hospital, Paris (France). Dept. de Chirurgie Cardiaque.
DEFINITION AND DEVELOPMENT OF AN INFORMATION SYSTEM FOR CARDIAC DISEASE INTENSIVE CARE UNITS Final Report [DEFINITION ET REALISATION D'UN SYSTEME INFORMATIQUE DESTINE A UNE UNITE DE SOINS INTENSIFS CARDIOLOGIQUES]
C. Cabrol and F. Gremy (Soc. TITN) Dec. 1973 23 p refs In FRENCH
(Contract DGRST-72-7-0124)
Avail: NTIS HC $3.25

A modular patient monitoring system with a dialog input-output facility and a minicomputer was tested. Further development includes a rehyphenanimation data bank in connection with a time-sharing computer. Arterial pressure and electrocardiograms, ventriculav complexes and arrythenias, and internal monitoring are automatically furnished, and manual data can be entered into the system through the dialog terminal. ESRO

N75-28696*# Naval Aerospace Medical Research Lab., Pensacola, Fla.
MICRODOSIMETRIC STRUCTURE OF HZE PARTICLE TRACKS IN TISSUE
Hermann J. Schaefer 8 Apr. 1975 22 p refs
(NASA Order W-13280)
(NASA-CR-141935; NAMRL-1214) Avail: NTIS HC $3.25 CSCL 06R

Heavy nuclei of the primary galactic radiation in space can have the same linear energy transfer yet greatly different lateral distribution patterns of the energy in the microstructure of tissue. Track structure thus presents itself as a new dosimetric parameter for HZE particles which is at present incompletely understood in its radiobiological significance. The theory of track structure distinguishes two regions: core and penumbra. The core is a narrow region with a radius far below 1 micron in tissue where energy deposition occurs mainly through excitations and collective oscillations of electrons. Energy density in the core accounts for slightly more than half the total LET. The penumbra surrounding the core extends laterally several to many microns depending on the energy of the primary. Energy density in the penumbra decreases steeply with the square of increasing radius. The relationships are illustrated with nuclear emulsion micrographs and plots of energy density profiles. The implications of the findings for a dosimetric system for HZE particles are discussed. Author

N75-28697*# California Univ., La Jolla. Dept. of Neurosciences.
BRAINSTEM AUDITORY EVOKED RESPONSES IN MAN. 1: EFFECT OF STIMULUS RISE-FALL TIME AND DURATION
Kurt Hecox, Nancy Squires, and Robert Galambos [1975] 28 p refs
(Grants NGR-05-009-198; PHS-NS-10482-01)
(NASA-CR-143257) Avail: NTIS HC $3.75 CSCL 06P

Short latency (under 10 msec) responses elicited by bursts of white noise were recorded from the scalps of human subjects. Response alterations produced by changes in the noise burst duration (on-time), inter-burst interval (off-time), and onset and offset shapes were analyzed. The latency of the most prominent response component, wave V, was markedly delayed with increases in stimulus rise time but was unaffected by changes in fall time. Increases in stimulus duration, and therefore in loudness, resulted in a systematic increase in latency. This was probably due to response recovery processes, since the effect was eliminated with increases in stimulus off-time. The amplitude of wave V was insensitive to changes in signal rise and fall times, while increasing signal on-time produced smaller amplitude responses only for sufficiently short off-times. It was concluded that wave V of the human auditory brainstem evoked response is solely an onset response. Author

N75-28698*# Grambling State Univ., La.
LYMPHOID CELL KINETICS UNDER CONTINUOUS LOW DOSE-RATE GAMMA IRRADIATION: A COMPARISON STUDY Final Technical Report
Bessie R. Foster 31 Jul. 1975 39 p refs
(Grant NsG-9014)
(NASA-CR-143262) Avail: NTIS HC $3.75 CSCL 06R

A comparison study was conducted of the effects of continuous low dose-rate gamma irradiation on cell population kinetics of lymphoid tissue (white pulp) of the mouse spleen with findings as they relate to the mouse thymus. Experimental techniques employed included autoradiography and specific labeling with tritiated thymidine (TdR-(h-3)). The problem studied involved the mechanism of cell proliferation of lymphoid tissue of the mouse spleen and thymus under the stress of continuous irradiation at a dose rate of 10 roentgens (R) per day for 105 days (15 weeks). The aim was to determine whether or not a steady state or near-steady state of cell population could be established for this period of time, and what compensatory mechanisms of cell population were involved. Author

N75-28699*# Scientific Translation Service, Santa Barbara, Calif.
NEW MOSCOW HYPERBARIC-OXYGENATION BARO-HOSPITAL
S. Yelkina, I. Mishina, S. Tutorskaya, G. Lomanov, and I. Melenevskiy Washington NASA Jul. 1975 23 p Transl. into ENGLISH from various Russian publications
(Contract NASw-2483)

(NASA-TT-F-16464) Avail: NTIS HC $3.25 CSCL 06L

The following studies are presented: an operation in the barohospital; high pressure medicine; healing with the pressure chamber; pressure chambers in the clinic; and an operation in the pressure chamber. Author

N75-28700# Retina Foundation, Boston, Mass.

DESIGN AND CONSTRUCTION OF A WIDE ANGLE OPHTHALMOSCOPE AND CAMERA Final Report, 1 Jun. 1973 - 31 May 1974

Oleg Pomerantzeff 24 Jan. 1975 15 p

(Contract DADA17-73-C-3144)

(AD-A005038) Avail: NTIS CSCL 06/12

The purpose of the project was to design a camera capable of photographing the entire fundus of the eye in a single exposure. One of the main design problems was the haze created over the central part of the retinal image by reflections from crystalline lens. This problem was solved after termination of the contract. GRA

N75-28701# Human Engineering Labs., Aberdeen Proving Ground, Md.

A DESCRIPTIVE MODEL OF NEGATIVE TTS FROM IMPULSES Final Report

David C. Hodge Jan. 1975 18 p refs

(AD-A005025; HEL-TN-1-75) Avail: NTIS CSCL 05/10

Sometimes hearing thresholds are more sensitive after impulse-noise exposure than before. This phenomenon has been called negative TTS (temporary threshold shift). A descriptive model of negative TTS is presented, together with a review of the empirical evidence supporting the model. It is suggested that a release from inhibition mechanism may be responsible for the negative TTS phenomenon. GRA

N75-28702# Naval Aerospace Medical Research Lab., Pensacola, Fla.

THE BRIEF VESTIBULAR DISORIENTATION TEST AS AN ASSESSMENT TOOL FOR NON-PILOT AVIATION PERSONNEL

Rosalie K. Ambler and Fred E. Guedry, Jr. 16 Oct. 1974 22 p refs

(AD-A004963; NAMRL-1210; USAARL-75-7) Avail: NTIS CSCL 06/14

Past research has demonstrated the value of the Brief Vestibular Disorientation Test (BVDT) as a screening tool for student pilots. This study is concerned with the extension of this technique for use in assessing the potential Naval Flight Officer (NFO). The rater BVDT procedure was used here, and in addition, a performance task involving a short-term memory task in the auditory mode was introduced in order to measure performance decrement. Representative groups of entering NFO students were first administered the performance task under the exact conditions of the previous BVDT procedure, but without rotation. After a 2-minute rest period, the procedure was repeated with rotation. Observer assessments were made during this rotation sequence. The results indicate that those students who later failed NFO training exhibited greater performance decrement under rotary conditions as compared to static than did successful students. Rater-type BVDT scores also indicated slightly greater sensitivity (0.7 level of significance) to the vestibular stimulus for the failures than for the successes. It was concluded that this technique is of value in screening NFO's. GRA

N75-28703# Naval Surface Weapons Center, Dahlgren, Va.

THE EFFECTS OF HIGH POWER PULSED AND LOW LEVEL CW MICROWAVE RADIATION ON AN OPERANT BEHAVIOR IN RATS

Joseph A. Diachenko and William C. Milroy Jan. 1975 24 p refs

(AD-A004943; NSWC/DL-TR-3230) Avail: NTIS CSCL 06/18

The two experiments reported were aimed at studying the effects of pulsed and low-level CW microwave radiation on an operant behavior in rats. The subjects were trained to perform a lever pressing response on a DRL schedule (Differential Reinforcement of Low Rate) and tested immediately after one hour daily exposure to 1, 5, 10, 15 (milliwatts per square cm) power levels at 2,450 MHz while other subjects were exposed to a pulsed field of 125 kilovolt per meter. No effects were found at the 1, 5, and 10 (milliwatts per square cm) levels nor did the pulsed field affect performance. However, the subjects exposed to the 15 (milliwatts per square cm), while showing no significant decrement in performance, did show obvious signs of heat stress. GRA

N75-28673 Joint Publications Research Service, Arlington, Va.

AEROSPACE MEDICINE: ON THE THIRTIETH ANNIVERSARY OF THE VICTORY OF THE SOVIET PEOPLE IN THE GREAT FATHERLAND WAR

N. M. Rudnyy *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 1-7 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 3-7 (For availability see N75-28672 19-51)

N75-28679 Joint Publications Research Service, Arlington, Va.

MODEL OF THE TRANSPORT OF GASES IN PERIODICALLY VENTILATED LUNGS

V. G. Shabelnikov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 42-49 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 28-34 (For availability see N75-28672 19-51)

N75-28682 Joint Publications Research Service, Arlington, Va.

HYPOBARIC NITROGEN-OXYGEN ATMOSPHERE AS A METHOD FOR PREVENTING HIGH-ALTITUDE DECOMPRESSION DISEASE

A. M. Genin, I. N. Chernyakov, I. V. Maksimov, and V. A. Glazkova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 71-76 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 48-52 (For availability see N75-28672 19-51)

N75-28684 Joint Publications Research Service, Arlington, Va.

CHANGES IN INDICES OF THE BLOOD COAGULATING AND ANTICOAGULATING SYSTEM IN FLIGHT CREWS UNDER THE INFLUENCE OF FLIGHT FACTORS

Ye. S. Nodova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 83-88 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 56-60 (For availability see N75-28672 19-51)

N75-28685 Joint Publications Research Service, Arlington, Va.

CHANGE IN ASYMMETRY OF SOME PAIRED FUNCTIONS IN AIRMEN UNDER THE INFLUENCE OF FLIGHT FACTORS

V. A. Yegorov and V. K. Shirogorov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 89-95 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 60-64 (For availability see N75-28672 19-51)

N75-28687 Joint Publications Research Service, Arlington, Va.

MAN'S TOLERANCE OF CORIOLIS ACCELERATIONS WITH LOADING OF DIFFERENT MUSCLE GROUPS

G. S. Ayzikov, M. D. Yemelyanov, and V. G. Ovechkin *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 103-111 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 69-74 (For availability see N75-28672 19-51)

N75-28688 Joint Publications Research Service, Arlington, Va.

METHOD FOR COMPUTING THE RADIATION DANGER FROM PROTON SOLAR FLARES

V. L. Generozov, A. V. Kolomenskiy, and V. A. Sakovich *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 112-118 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 74-78 (For availability see N75-28672 19-51)

N75-28692 Joint Publications Research Service, Arlington, Va.

GENESIS OF VESTIBULAR-AUTONOMIC DISORDERS IN SPACEFLIGHT

I. I. Bryanov, E. I. Matsnev, and I. Ya. Yakovleva *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301)

24 Jul. 1975 p 133-140 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 85-88 (For availability see N75-28672 19-51)

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N75-28704# URS/Matrix Co., Falls Church, Va.
EVALUATING MAINTENANCE PERFORMANCE. VOLUME 3: THE DEVELOPMENT OF GRAPHIC SYMBOLIC SUBSTITUTES FOR CRITERION REFERENCED JOB TASK PERFORMANCE TESTS FOR ELECTRONIC MAINTENANCE Final Report, 1 Apr. 1970 - 28 Jun. 1974
Edgar L. Shriver and John P. Foley, Jr. Nov. 1974 75 p refs
(Contracts F33615-70-C-1550; F33615-71-C-1505; AF Proj. 1710)
(AD-A005296; AFHRL-TR-74-57-Vol-3) Avail: NTIS CSCL 05/9

An in-depth review of the literature reported in AFHRL-TR-74-57(I), of this series of documents strongly reiterated the fact that paper and pencil tests of job knowledge and electronic theory tests have very poor criterion-related or empirical validity with respect to the ability of electronic maintenance men for performing their tasks. As a result, a battery of criterion referenced Job Task Performance Tests (JTPT) was developed and tried out and results were reported in AFHRL-TR-57(II). The battery included tests for the various job activities performed by electronic maintenance technicians such as checkout, align/adjust, remove/replace, soldering, use of general and special test equipment, and troubleshooting. In this report, a battery of symbolic tests was developed including a companion symbolic test for each of the job activities for which a criterion referenced JTPT had previously been developed. Based on two limited validations, all of the graphic symbolic tests, with the exception of the symbolic test for soldering, indicated sufficient promise to justify further consideration and refinement. All of these promising symbolic tests should be given more extensive validations using larger numbers of experienced subjects. The validation of any such symbolic test requires the administration of a companion JTPT as a validation criterion. As a result, a validation is an expensive process in terms of equipment and experienced manpower. The troubleshooting symbolic tests require the most extensive refinement. Several suggestions are made for improving their empirical validity. GRA

N75-28705# URS/Matrix Co., Falls Church, Va.
EVALUATING MAINTENANCE PERFORMANCE. VOLUME 4: A VIDEO APPROACH TO SYMBOLIC TESTING OF ELECTRONICS MAINTENANCE TASKS Final Report, 30 Apr. 1971 - 30 Jun. 1973
Edgar L. Shriver, John F. Hayes, and William R. Hufhand Jul. 1974 20 p ref
(Contract F33615-71-C-1505; AF Proj. 1710)
(AD-A005297; AFHRL-TR-74-57-Vol-4) Avail: NTIS

The volume reports an effort to use the video media as an approach for the preparation of a battery of symbolic tests that would be empirically valid substitutes for criterion referenced Job Task Performance Tests. The development and tryout of such criterion referenced tests and promising graphic symbolic substitute tests are reported in previous volumes. The graphic symbolic tests require the storage of a large amount of pictorial information which must be searched rapidly for display. At the time this video effort was started, no completely satisfactory way had been found for rapidly searching and displaying such information. In addition, some dynamic displays would have been desirable for those graphic symbolics whereas all of the original graphic pictorials are static. The anticipated results that the video media would provide satisfactory and economical solutions to these problems, did not materialize. GRA

N75-28706# Dunlap and Associates, Inc., La Jolla, Calif.
LONGITUDINAL STUDY OF ENVIRONMENTAL VARIABLES AND AVIATION PERFORMANCE EFFECTIVENESS Final Report
Clyde A. Brictson Jan. 1975 25 p refs
(Contract N00014-73-C-0053; NR Proj. 201-146)
(AD-A005423) Avail: NTIS CSCL 06/19

A research program which investigated environmental variables of aviation performance effectiveness is described. Physiological, psychological, sleep and performance data were collected in a combat environment to describe and predict the influence of prolonged periods of stress on pilot landing performance. Significant predictions of pilot performance from experience, biochemical sleep and mood data were obtained. A cross validation of pilot landing performance in a replacement air group environment was successfully carried out but not without substantial shrinkage of the original multiple Rs. Finally, a description of landing signal officers perceptual skills and their potential relation to the LSO fleet environment is presented along with implications for Navy implementation. Research recommendations and future programs related to environmental psychology are suggested. GRA

N75-28707# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN ENGINEERING LABORATORY HELICOPTER ACQUISITION TEST (HELHAT) Final Report
John A. Barnes Sep. 1974 228 p refs
(AD-A005559; HEL-TM-20-74) Avail: NTIS CSCL 17/8

The U.S. Army Human Engineering Laboratory conducted a series of flight tests in 1972 (HELHAT I) and 1973 (HELHAT II) in which the low-level target acquisition performances of combat-trained OH-58 and AH-1 helicopter crewmen were measured. The stationary targets used were both ordnance and high-visibility box-type targets. This study contains all of the data gathered during these tests and also reports on the 25 performance variables measured for each of the 851 recorded target acquisitions. These variables were used to form the linear equations which were analyzed by the use of a step-wise multiple-regression technique in order to identify the variables contributing to stationary target acquisition performance. There were 831 acquisitions recorded during the low-level route reconnaissance flights flown at above the ground levels of 80 to approximately 400 feet and 20 acquisitions recorded during the six nap-of-the-earth's search reconnaissance flights flown at above the ground levels of 1 to approximately 40 feet. GRA

N75-28708# Human Engineering Labs., Aberdeen Proving Ground, Md.
HUMAN PERFORMANCE CRITERIA FOR MILITARY NOISE EXPOSURE Final Report
David C. Hodge and Joseph Mazurczak Jan. 1975 25 p refs
(AD-A005026; HEL-TN-2-75) Avail: NTIS CSCL 05/10

A new research program is described whose objectives include: identification of aural performance requirements of soldiers in tactical situations; quantification of the effects of aural acuity deficits on such performance; and development of models to predict the effects of military noise exposure on soldiers' performance. It is shown that soldiers need to be able to hear in the 100 Hz to 12 kHz range. Hearing losses are usually first observed at 4-6 kHz. Speech reception is relatively unaffected by typical hearing loss patterns, and can be predicted fairly well from audiometric data. Materiel sound detection is unaffected by typical hearing losses. Personnel sound detection is probably affected by typical hearing losses, and cannot be predicted from audiometric data. The program's current emphasis is on the relation between hearing acuity and high-frequency personnel sound detection. A description of the test environment is included. GRA

N75-28709# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF PILOT PERFORMANCE DURING A GLIDE-SLOPE APPROACH WHEN RATE INFORMATION IS SUPPLIED VIA THE PERIPHERAL VISION M.S. Thesis
Ernest L. Ener, Jr. Dec. 1974 92 p refs
(AD-A005284; GE/MA/74D-2) Avail: NTIS CSCL 05/10

A presentation is made of the findings of a fixed-base simulation study during which the rate of glide-slope deviation was provided via the peripheral vision to the pilot, while flying a simulated glide-slope approach. The method used to supply

glide-slope deviation was by the movement of alternating black and white lines displayed in the peripheral vision. Pilot performance was measured during glide-slope runs performed without the peripheral display and a comparison made with performance measured during use of the display. A presentation is also made of the findings of a simulation involving a second-order critical task. GRA

N75-28710# California Univ., Los Angeles. Lab. of Environmental Neurobiology.
NEUROPHYSIOLOGICAL ESTIMATES OF HUMAN PERFORMANCE CAPABILITIES IN AEROSPACE SYSTEMS Final Report, 1 Oct. 1969 - 30 Sep. 1974
W. R. Adey 27 Jan. 1975 46 p refs
(Contract F44620-70-C-0017)
(AD-A005690; Rept-1974A12R; AFOSR-75-0170TR) Avail: NTIS CSCL 06/19

The effects of 4.5, 6.0 and 7.0 +Gz acceleration levels on the electroencephalogram (EEG) were collaboratively studied with the USAFSAM. At no time did the EEG records suggest a significant impairment of cerebral functions. To achieve a separation of muscle and brain signals required development of new filtering methods which resulted in a capability for direct monitoring of brain function during severe physical stress in performing subjects. The need for adequate monitoring of diving performance ability resulted in the design of a new system using return-current density techniques. A wide range of studies have been conducted on cellular behavior in the visual system, in conditions of sleep and wakefulness, anesthesia, and as a concomitant of saccadic eye movements. Several studies were conducted on the unrestrained chimpanzee including sleep-wake cycles. GRA

N75-28711# California Univ., Los Angeles. Lab. of Environmental Neurobiology.
OPTIMIZING MANPOWER SELECTION Final Report, 1 Jun. - 31 Aug. 1974
John Hanley 31 Oct. 1974 98 p refs
(Contract F44620-73-C-0070; AF Proj. 6813)
(AD-A005689; Rept-1974H11; AFOSR-75-0169TR) Avail: NTIS CSCL 06/16

Electroencephalograms were obtained with conventional scalp disk electrodes bilaterally at frontal, temporal, parietal and occipital locations. Two sets of computer analyses were performed. The first consisted of transforming the data from the time domain to the frequency domain Fourier Transformation. The spectral measurements were input to a Linear Stepwise Discriminant Analysis which acts as a feature selector. Analyses revealed that the most consistent difference between the disabled readers and the normals was the degree of shared electrical activity between symmetrical locations in the two hemispheres, the absence of a well-developed narrow-band peak in the alpha band in the dyslexics and a narrow band alpha peak like that in normals in those dyslexics who had benefitted from remedial programs. GRA

N75-28712# Utah Univ., Salt Lake City. Human Resources Inst.
MECHANISMS FOR AIDING WORKER ADJUSTMENT TO TECHNOLOGICAL CHANGE: CONCEPT, REVIEW OF THE LITERATURE, ABSTRACTS. VOLUME 2: KEY WORK INDEX AND ABSTRACTS Final Report
Aug. 1974 444 p refs
(Grant NSF DA-39438)
(PB-241019/9; NSF/RDA-73/16/3) Avail: NTIS HC $11.25 CSCL 05I

The volume is an annotated bibliography covering the areas of worker adjustment to technological change. The key words and articles are grouped into four main areas: scope, level, and content; private adjustment mechanisms; public adjustment mechanisms; and methodology. The literature coverage extends from 1973 back to 1962. GRA

N75-28681 Joint Publications Research Service, Arlington, Va.
USE OF LENGTHENED AND SHORTENED DAYS ON SPACE FLIGHTS
S. I. Stepanova *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 55-70 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 37-48 (For availability see N75-28672 19-51)

N75-28686 Joint Publications Research Service, Arlington, Va.
PSYCHOPHYSIOLOGICAL CHARACTERISTICS OF THE WORK ACTIVITY OF AN OPERATOR WEARING SPECIAL GEAR
V. A. Ponomarenko, R. I. Brusnichkina, and N. A. Fedorov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 96-102 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 64-68 (For availability see N75-28672 19-51)

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

N75-28713 North Carolina State Univ., Raleigh.
INVESTIGATIONS OF ROLL AND PITCH IN OFF-ROAD VEHICLES INCLUDING ACTIVE SEAT SUSPENSION Ph.D. Thesis
Roy Edward Young 1972 156 p
Avail: Univ. Microfilms Order No. 75-15911

The roll and pitch vibrations of off-road vehicles was studied. Two angular accelerometers were orthogonally mounted at the seat-chassis interface of a pneumatic-tired tractor. The tractor was operated at 2.6 mph over a test track containing full sine, 6 inch high rectangular and 1.6 inch high rectangular obstacles. Spectrogram analysis of the accelerometer outputs showed that roll acceleration levels were significantly greater than pitch acceleration levels. Peak acceleration levels occurred around 1.1 Hz in roll and 4.5 Hz in pitch. Above 5 Hz, both roll and pitch acceleration levels subsided. A computer model of roll and pitch was developed which is adaptable to the physical dimensions of any off-road vehicle. An active rotational seat suspension system was constructed. The system consists of an angular displacement transducer utilized as the command source for an electrohydraulic feedback control system designed to move the seat in antiphase with the input vibration. Dissert. Abstr.

N75-28714# Southwest Research Inst., San Antonio, Tex.
DEVELOPMENT OF CRITERIA FOR THE RECIRCULATION OF EXHAUST AIR Final Report
William J. Astleford Jul. 1975 270 p refs
(Contract CDC-99-74-96; SwRI Proj. 02-4011)
Avail: NTIS HC $8.50

Contaminant toxicity, the requirements for air monitoring and air cleaning equipment, reliability analyses of fail-safe systems, and theoretical modeling of system performance are described. Analytical recirculation models are developed to predict the transient response of workroom concentration as a function of contaminant generation rate, room volume, general and recirculated air flows, and the air cleaner and local exhaust hood capture efficiencies. The effect of air cleaner failure and bypass of exhaust air to the atmosphere are also modeled. For individual titles, see N75-28715 through N75-28718.

N75-28715 Southwest Research Inst., San Antonio, Tex.
DETERMINATION AND CATEGORIZATION OF RECIRCULATABLE CONTAMINANTS
In its Develop. of Criteria for the Recirculation of Exhaust Air Jul. 1975 p 4-19 refs (For availability see N75-28714 19-54)

The Threshold Limit Value (TLV) Table for 1973, is discussed which contains in excess of 500 chemical substances that may be present in industrial workroom air. Because recirculated exhaust air systems and the development of appropriate performance criteria are still in the neophyte stage, a process or industry-oriented approach to contaminant selection was not indicated. Therefore, each contaminant was considered as a separate entity. Consequently, additive or synergistic effects resulting from recirculation of multiple contaminants were excluded from this study. Author

N75-28716 Southwest Research Inst., San Antonio, Tex.
STATE-OF-THE-ART OF COMMERCIALLY AVAILABLE AIR CLEANING EQUIPMENT
In its Develop. of Criteria for the Recirculation of Exhaust Air Jul. 1975 p 20-29 refs (For availability see N75-28714 19-54)

The two main objectives of this equipment assessment task are to: (1) perform a technical review of the product specifications that are published by manufacturers of air cleaning devices. The utlimate purpose of this review was to select a recommended air cleaner for each contaminant in Groups 1 through 4 and to construct a list of purchasers of cleaning devices for a review of user experience. Insofar as was possible, the air cleaner recommendations that were performed under this task are presented. (2) Conduct a review of user experience in order to gather performance, failure rate and maintenance data on selected air cleaners for input to a reliability and fail-safe system analysis. Author

N75-28717 Southwest Research Inst., San Antonio, Tex.
RELIABILITY, MAINTENANCE, FAIL-SAFE, CONTROL AND SAMPLING PROVISIONS FOR RECIRCULATED EXHAUST AIR SYSTEMS
In its Develop. of Criteria for the Recirculation of Exhaust Air Jul. 1975 p 30-104 refs (For availability see N75-28714 19-54)

Worker safety should be the dominant consideration in the design of a recirculated exhaust air system for industrial applications. The design must, therefore, be fail-safe in the sense that it minimizes the probability of excessive exposure to workroom contaminants caused by failure of a major system component or subsystem. In this section, two recirculation models are developed, and each model is analyzed for system reliability. The requirements for monitoring and automatic control systems are investigated. Author

N75-28718 Southwest Research Inst., San Antonio, Tex.
ANALYTICAL RECIRCULATION MODELS
In its Develop. of Criteria for the Recirculation of Exhaust Air Jul. 1975 p 105-129 refs (For availability see N75-28714 19-54)

An analytical model is required in order to determine the ranges of system parameters that will maintain the workplace concentration below the TLV and to weigh various alternatives in selecting system components. A model is developed which specifies the required recirculation flow rate or the allowable concentration in the recirculated air discharge in terms of the release rate of the contaminant, the efficiency of the air cleaning system, the overall ventilation rate, and the TLV of the contaminant. Author

N75-28719*# Texas Univ. Health Science Center, Houston. School of Public Health.
FOOD SAFETY Final Report
Stanley M. Pier and Jane L. Valentine [1975] 95 p refs
(Contract NAS9-11701)
(NASA-CR-141928) Avail: NTIS HC $4.75 CSCL 06H

Illness induced by unsafe food is a problem of great public health significance. This study relates exclusively to the occurrence of chemical agents which will result in food unsafe for human consumption since the matter of food safety is of paramount importance in the mission and operation of the manned spacecraft program of the National Aeronautics and Space Administration. Author

N75-28720*# Life Systems, Inc., Cleveland, Ohio.
ADVANCED WATER IODINATING SYSTEM Final Report, 3 May 1974 - 28 Feb. 1975
R. J. Davenport, F. H. Schubert, and R. A. Wynveen Feb. 1975 244 p refs
(Contract NAS9-13931)
(NASA-CR-141937; LSI-ER-218-3) Avail: NTIS HC $7.50 CSCL 06I

Potable water stores aboard manned spacecraft must remain sterile. Suitable sterilization techniques are needed to prevent microbial growth. The development of an advanced water iodinating system for possible application to the shuttle orbiter and other advanced spacecraft, is considered. The AWIS provides a means of automatically dispensing iodine and controlling iodination levels in potable water stores. In a recirculation mode test, simulating application of the AWIS to a water management system of a long term six man capacity space mission, noniodinated feed water flowing at 32.2 cu cm min was iodinated to 5 + or - ppm concentrations after it was mixed with previously iodinated water recirculating through a potable water storage tank. Also, the AWIS was used to successfully demonstrate its capability to maintain potable water at a desired I2 concentration level while circulating through the water storage tank, but without the addition of noniodinated water. Author

N75-28721*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Bioengineering Organization.
DESIGN, FABRICATION AND TESTING OF A WET OXIDATION WASTE PROCESSING SYSTEM Final Report
15 May 1975 116 p refs
(Contract NAS1-11748)
(NASA-CR-141916) Avail: NTIS HC $5.25 CSCL 06K

The wet oxidation of sewage sludge during space flight was studied for water and gas recovery, and the elimination of overboard venting. The components of the system are described. Slurry and oxygen supply modules were fabricated and tested. Recommendations for redesign of the equipment are included. F.O.S.

N75-28722*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
SKYLAB MOBILE LABORATORY
Gary R. Primeaux and Maurice A. LaRue (Martin Marietta Corp.) Washington Jul. 1975 61 p
(NASA-TN-D-8028; JSC-S-429) Avail: NTIS HC $4.25 CSCL 22B

The Skylab mobile laboratory was designed to provide the capability to obtain necessary data on the Skylab crewmen 30 days before lift-off, within 1 hour after recovery, and until preflight physiological baselines were reattained. The mobile laboratory complex consisted of six laboratories that supported cardiovascular, metabolic, nutrition and endocrinology, operational medicine, blood, and microbiology experiments; a utility package; and two shipping containers. The objectives and equipment requirements of the Skylab mobile laboratory and the data acquisition systems are discussed along with processes such as permanently mounting equipment in the individual laboratories and methods of testing and transporting the units. The operational performance, in terms of amounts of data collected, and the concept of mobile laboratories for medical and scientific experiments are evaluated. The Skylab mobile laboratory succeeded in facilitating the data collection and sample preservation associated with the three Skylab manned flights. Author

N75-28723# Naval Underwater Systems Center, New London, Conn.
VISUAL SAMPLING ON A SIMULATED DIMUS-TYPE DISPLAY
Richard L. Mason 27 Jan. 1975 56 p refs
(AD-A005318; NUSC-TR-4861) Avail: NTIS CSCL 05/8

Experienced sonar operators were used to study the visual search on a simulated DIMUS display. The electro-oculargram was used to estimate the location and amount of time spent in each eye fixation on the display made while the operators searched for targets. The data obtained were analyzed to determine the eye movement parameters, the visual coverage of the display, and the relation between operator attention to areas on the display and the display data in those areas. It was found that the operator search of the display is not only nonuniform, but it is also incomplete. The operator viewing time was not uniformly distributed across the display, and, on most presentations, some areas of the display were not even fixed. Thus, the probability of target detection depends on the target location on the display. GRA

N75-28724# Mine Safety Appliances Co., Pittsburgh, Pa. Research and Engineering Div.
SHORT DURATION SELF-RESCUE BREATHING APPARATUS
E. E. Buban and R. E. Gray 1 Apr. 1974 122 p refs
(Contract DI-BM-HO-220071)
(PB-240471; BM-OFR-6-75) Avail: NTIS HC $5.25 CSCL 06G

A self contained breathing apparatus was developed to provide complete respiratory protection for a miner in an irrespirable atmosphere. The apparatus has the desired features of comfort, reliability, maintainability, and quick-donning capability. The apparatus is packaged in a moistureproof envelope and is protected in a shock-absorbing, fiberglass resin-carrying case. The apparatus is a small, light-weight, one-time-use device that can be readily worn on a miner's belt, requires no maintenance and is designed to have a shelf life of five years and a carrying life of three years. It is deployed to the use position in a period of 15 to 30 seconds. Man tests conducted in-house established that this unit meets all performance requirements listed in the Code of Federal Regulations. GRA

N75-28725# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ONE-HOUR SELF-RESCUE BREATHING APPARATUS Technical Report, Jul. 1972 - Sep. 1974
Oct. 1974 122 p refs
(Contract DI-BM-HO-220040)
(PB-240420/0; LMSC-D401004; BuMines-OFR-8-75) Avail: NTIS HC $5.25 CSCL 06G

A one-hour, 4.5-pound, self-contained emergency breathing apparatus tested and approved by the National Institute for Occupational Safety and Health and the Mining Enforcement and Safety Administration for underground coal mines is described. The unit is used by miners to replace the existing self rescuers. It provides a minimum of one hour of breathable atmosphere during escape from a mine with contaminated or oxygen-deficient atmosphere. Contract requirements and accomplishments of the development program are summarized along with a description of the apparatus (PBA), including the functions of the components. GRA

N75-28726# Defense Documentation Center, Alexandria, Va.
PROTECTIVE CLOTHING Report Bibliography, Jan. 1953 - Jun. 1974
Jan. 1975 329 p refs
(AD-A005300; DDC-TAS-74-38) Avail: NTIS CSCL 06/17

The bibliography contains unclassified and unlimited citations. Discussed are protective clothing such as fire protective clothing, flight clothing, gasproof clothing, underwater clothing, pressure suits, and exposure suits. It also includes pertinent information on stress physiological, psychological and biological aspects of human performance in the use of protective clothing in actual test. GRA

N75-28727# Army Chemical Center, Edgewood, Md.
THERMAL PERFORMANCE OF PERMEABLE VERSUS IMPERMEABLE HOODS WORN BY MEN IN CB ENSEMBLE WORKING IN A TROPICAL ENVIRONMENT
Arthur T. Johnson Jan. 1975 31 p
(DA Proj. 1W7-62710-A-095)
(AD-A005613; ED-TR-74081) Avail: NTIS CSCL 06/17

A hood fabricated from twill cloth with air permeability of 175 cu ft/sq ft/min of 0.5 inch of water was evaluated by comparison with the standard impermeable hood and no hooded condition. Men walked for 6.5 miles at an average rate of 2.5 mph in a hot environment with average wet bulb globe temperature between 81 and 87 F. Twelve replications were performed. The permeable hood was found to be statistically different from either impermeable hood or no hood. Very little operational advantage can be gained, however, by depending solely on the impermeable hood to remove excess heat. Author

N75-28728# Army Chemical Center, Edgewood, Md.
A METHOD FOR SOFT BODY ARMOR EVALUATION: MEDICAL ASSESSMENT Technical Report, Jul. 1973 - Jun. 1974
Michael A. Goldfarb, Terrence F. Ciurej, Michael A. Weinstein, and Le Roy W. Metker Jan. 1975 32 p refs
(AD-A005575; EB-TR-74073) Avail: NTIS CSCL 06/17

As part of a project to evaluate the protection afforded by soft body armor using goats, the authors tested the validity of certain assumptions concerning the extrapolation of damage to the goat to damage to a human. Much of this report concerns the goat-human correlation. The consequences of an impact of a .38 caliber bullet traveling at a velocity of 800 feet per second (fps) when the area of impact was covered with a 7-ply Kevlar protective garment were studied in the goat. The blunt trauma experienced was correlated with expected damage if a human had been the target. It was concluded that without the garment, the mortality after a random hit with a .38 caliber bullet is between 6.9% to 25.4%. If the garment is worn, the mortality is decreased to 1% to 5%. The chance of surgery being needed when the armor is not worn is 81.5% to 100% and when the armor is worn is 7% to 10%. GRA

N75-28674 Joint Publications Research Service, Arlington, Va.
EXPERIMENT WITH A PHYSIOLOGICALLY ACTIVE CHLORELLA CULTURE ON THE SOYUZ-9 SPACESHIP
E. V. Moskvitin and E. N. Vaulina *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 8-13 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 7-10 (For availability see N75-28672 19-51)

N75-28678 Joint Publications Research Service, Arlington, Va.
COMPARATIVE CHARACTERISTICS OF POLY- AND MONOMER PROTEIN NUTRITION AS APPLICABLE TO SPACE FLIGHTS
V. G. Vysotskiy *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 33-41 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 23-28 (For availability see N75-28672 19-51)

N75-28680 Joint Publications Research Service, Arlington, Va.
SOME THEORETICAL ASPECTS OF CONSTRUCTING MEDICAL MONITORING SYSTEMS IN SPACE FLIGHTS
N. N. Gurovskiy and A. D. Yegorov *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 50-54 Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 34-37 (For availability see N75-28672 19-51)

N75-28690 Joint Publications Research Service, Arlington, Va.
EXPERIMENT WITH CHLORELLA ABOARD THE ZOND-8 AUTOMATIC STATION
E. N. Vaulina and E. V. Moskvitin *In its* Space Biol. and Aerospace Med., Vol. 9, No. 3, 1975 (JPRS-65301) 24 Jul. 1975 p 124-128 refs Transl. into ENGLISH from Kosm. Biol. Aviakosm. Med. (Moscow), v. 9, no. 3, 1975 p 81-83 (For availability see N75-28672 19-51)

55 PLANETARY BIOLOGY

Includes exobiology and extraterrestrial life.

No abstracts in this category.

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes computer graphics and data processing.

For components see *33 Electronics and Electrical Engineering*.

N75-28729 British Library Lending Div., Boston Spa (England).
COMPUTER-AIDED DESIGN AND CONSTRUCTION WITH FINITE ONE, TWO AND THREE DIMENSIONAL ELEMENTS
I. Grieger 9 Jul. 1974 29 p refs Transl. into ENGLISH from Angew. Informatik (West Germany), no. 3, 1973 p 101-113 In ENGLISH and GERMAN
(BLL-NEL-TT-2563-(6075.461)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

Geometry approximation was used to form one, two, and three dimensional elements for computer-aided design. The elements lend themselves readily to the representation and modification of structures on the cathode ray tube screen. Procedures are indicated for man-machine interaction, and a number of applications are presented to illustrate the concept of finite elements. Author

N75-28730 Maryland Univ., College Park.
ANALYSIS AND IMPLEMENTATION OF INTERVAL NUMBER COMPUTATION AND ESTIMATION PROCESSES Ph.D. Thesis
Robert Emile Joseph 1974 264 p
Avail: Univ. Microfilms Order No. 75-14303

Several applications requiring interval number data sets are cited with some emphasis placed on noise pollution monitoring techniques. Aspects in the design of an overall system consisting of an interval computer and a real-time error processor were investigated. Specifically, an integrated arithmetic logic unit capable of interval as well as discrete number arithmetic operations is described. Various algorithms for basic interval arithmetic operations are described. A microprogrammed processor with stack preprocessing and a pipelined instruction execution is presented in detail. Several classes of algorithms are presented with definitions and algorithmic procedures in the fields of estimation and error analysis. These procedures allow for interval number processing and are expected to contribute to the theoretical and algorithmic foundation needed for the implementation of the error processor unit. Dissert. Abstr.

N75-28731+ Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
IMPROVEMENT OF PROM'S WRITING BY LOCALIZED THERMAL OXIDATION Final Report [PERFECTIONNEMENT DES MEMOIRES PROM. ECRITURE PAR OXYDATION THERMIQUE LOCALISEE]
M. Croset, R. PerezdelaSota, and G. Velasco Aug. 1974 34 p In FRENCH
(Contract DGRST-73-7-1326)
Avail: NTIS HC $3.75

A new microelectronic component to be integrated in memory circuits PROM is presented. It switches from a non conducting to a conducting state following a Joule heating driven oxidation. Such heating may stem from a write current passing through a thin metallic sheet. Write times lower than 0.1 ms are reported for Ta and Za components. The electrical parameters are dependent on initial metal resistivity and component geometry. They are accounted for in a phenomenological model. A 256 bit PROM was built on Si diffused and oxidized substrate. Reliability is reported good. ESRO

N75-28732*# Westinghouse Electric Corp., Baltimore, Md. Defense and Electronics System Center.
CAMERA MEMORY STUDY FOR LARGE SPACE TELESCOPE Final Report, Apr. 1974 - Jan. 1975
C. P. Hoffman, J. E. Brewer, E. A. Brager, and D. L. Farnsworth Feb. 1975 247 p refs
(Contract NAS5-20512)
(NASA-CR-143815) Avail: NTIS HC $7.50 CSCL 09B

Specifications were developed for a memory system to be used as the storage media for camera detectors on the large space telescope (LST) satellite. Detectors with limited internal storage time such as intensities charge coupled devices and silicon intensified targets are implied. The general characteristics are reported of different approaches to the memory system with comparisons made within the guidelines set forth for the LST application. Priority ordering of comparisons is on the basis of cost, reliability, power, and physical characteristics. Specific rationales are provided for the rejection of unsuitable memory technologies. A recommended technology was selected and used to establish specifications for a breadboard memory. Procurement scheduling is provided for delivery of system breadboards in 1976, prototypes in 1978, and space qualified units in 1980. Author

N75-28733*# Wisconsin Univ., Madison. Space Science and Engineering Center.
MAN-COMPUTER INTERACTIVE DATA ACCESS SYSTEM (MCIDAS). CONTINUED DEVELOPMENT OF MCIDAS AND OPERATION IN THE GARP ATLANTIC TROPICAL EXPERIMENT Final Report, Aug. 1973 - Dec. 1974
Verner E. Suomi Mar. 1975 255 p
(Contract NAS5-23296)
(NASA-CR-143818) Avail: NTIS HC $8.50 CSCL 09B

The complete output of the Synchronous Meteorological Satellite was recorded on one inch magnetic tape. A quality control subsystem tests cloud track vectors against four sets of criteria: (1) rejection if best match occurs on correlation boundary; (2) rejection if major correlation peak is not distinct and significantly greater than secondary peak; (3) rejection if correlation is not persistent; and (4) rejection if acceleration is too great. A cloud height program determines cloud optical thickness from visible data and computer infrared emissivity. From infrared data and temperature profile, cloud height is determined. A functional description and electronic schematics of equipment are given. Author

N75-28734*# Wisconsin Univ., Madison.
SCHEMATICS FOR MAN-COMPUTER INTERACTIVE DATA ACCESS SYSTEM (MCIDAS), BOOK 1 Final Report
Mar. 1975 198 p
(Contract NAS5-23296)
(NASA-CR-143825) Avail: NTIS HC $7.00 CSCL 09B
For abstract, see N75-28733.

N75-28735*# Wisconsin Univ., Madison.
SCHEMATICS FOR MAN-COMPUTER INTERACTIVE DATA ACCESS SYSTEM (MCIDAS), BOOK 2 Final Report
Mar. 1975 149 p
(Contract NAS5-23296)
(NASA-CR-143826) Avail: NTIS $5.75 CSCL 09B
For abstract, see N75-28733.

N75-28736*# Wisconsin Univ., Madison.
SCHEMATICS FOR MAN-COMPUTER INTERACTIVE DATA ACCESS SYSTEM (MCIDAS), BOOK 3 Final Report
Mar. 1975 109 p
(Contract NAS5-23296)
(NASA-CR-143824) Avail: NTIS HC $5.25 CSCL 09B
For abstract, see N75-28733.

N75-28737*# Wisconsin Univ., Madison.
SCHEMATICS FOR MAN-COMPUTER INTERACTIVE DATA ACCESS SYSTEM (MCIDAS), BOOK 4 Final Report
Mar. 1975 99 p
(Contract NAS5-23296)
(NASA-CR-143823) Avail: NTIS HC $4.75 CSCL 09B
For abstract, see N75-28733.

N75-28738# Computer Sciences Corp., Los Angeles, Calif.
JOCIT JOVIAL COMPUTER IMPLEMENTATION TOOL Final Report, Jun. 1972 - Sep. 1974
Terry L. Dunbar Jan. 1975 78 p refs
(Contract F30602-72-C-0467)
(AD-A005307; RADC-TR-74-322) Avail: NTIS CSCL 09/2

This project was undertaken with the technical objective of proving that a compiler-compiler could be developed which would automate the process of producing high quality compilers in less time and at less cost than so called hand-built compilers.

The main problems encountered with previous compilers built using automated techniques were their inefficient use of computing resources (core and processor time) and/or the inefficient machine oriented code which they generated. This effort resulted in the development of a compiler building tool, called JOCIT, for implementing JOVIAL/J3 compilers, and the compilers built using that tool exhibit none of the above negative characteristics. The most significant advances made by this effort in the area of compiler building tools were in the optimization and code generation phases of compilation. GRA

N75-28739# Boeing Computer Services, Inc., Seattle, Wash.
ASSOCIATIVE PROCESSOR APPLICATION STUDY Final Report, Aug. 1973 - Sep. 1974
Brian W. Prentice, Robert Katz, Ray Komajda, Heisun-Fei Lee, and Newton P. Nelson Jan. 1975 184 p refs
(Contract F30602-74-C-0025; AF Proj. 5550)
(AD-A005308; RADC-TR-74-326) Avail: NTIS CSCL 09/2

This report describes work performed in support of a research study on the applicability of using associative processing to meet the real-time high data rate processing requirements of the USAF. A GAC STARAN S-1000 associative processor was the object of this study. The work tasks described in the appendices of this document are a subset of those required to complete the RADC research study plan. The parallel implementations of both the AWACS active tracking and passive tracking functions on the RADC STARAN testbed should be completed. The performance of each of these programs should be measured and compared with the performance of their respective serial programs. The tasks required to complete this work are discussed. GRA

N75-28740# Bureau of Mines, Denver, Colo. Mining Research Center.
CONSTRUCTION OF AN INTERFACE BETWEEN A MINI-COMPUTER AND AN X, Y DIGITIZER Information Circular
Richard G. Burdick, Edward L. Douglas, and Joe Sena Jan. 1975 13 p
(PB-240668/4; BM-IC-8670) Avail: NTIS HC $3.25 CSCL 09B

This report describes an interface between a minicomputer and a peripheral device. The logic used to develop the device is discussed briefly, after which the device is described in detail and complete construction and operational details are given. The authors believe that this report will aid, not only in duplicating this device, but also in designing similar devices for different uses. Author

N75-28741# Mathematics and Computation Lab., McLean, Va.
STRING AND CHARACTER MANIPULATION ROUTINES FOR UNIVAC 1108 FORTRAN USERS Final Report
William H. Morrison Jan. 1975 38 p refs Sponsored by GSA
(PB-240932/4; GSA/OP/MCL-TM-248) Avail: NTIS MF $3.75 CSCL 09B

The software described is to facilitate the storing or transfer of data as a constant, array, or list to an array or list as well as to extend to FORTRAN users the capabilities of string manipulation of constants and strings. GRA

N75-28742# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
THE OPTIMAL SELECTION OF SECONDARY INDICES FOR FILES Interim Report
Mario Schkolnick Nov. 1974 17 p refs
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A005692) Avail: NTIS CSCL 09/2

The author considers the problem of finding an optimal set of indices for a file. A general model for a file is assumed together with a probabilistic model of the transactions conducted with it: Queries, Updates, Insertions and Deletions. It is shown that all the information assumed for each attribute can be condensed into two parameters and that properties of the optimal solution can be derived from this condensed information. An algorithm to find the optimal set of indices based on these properties is exhibited. GRA

N75-28743# Army Electronics Command, Fort Monmouth, N.J.
INVESTIGATION OF THE EFFICIENT CONNECTION OF VERY HIGH SPEED GRAPHICS TERMINALS TO A LARGE SCALE COMPUTING FACILITY Final Report
Edward B. Hirsch Feb. 1975 31 p refs
(Contract DAAK02-72-C-0284; AF Proj. 9030)
(AD-A005012; ECOM-4288) Avail: NTIS CSCL 09/2

The evolution of interactive computer graphics terminals and the systems used to support them are outlined. A rationale is given for data communication speeds out to the terminals of 50,000 bits/sec. Computer data communications systems can be classified according to the amount of information transferred per CPU interrupt. Such systems have been broken into three categories: character-at-a-time, line-at-a-time, and disk sector-at-a-time. The characteristics of each is given and the conclusion is drawn that for the postulated system of thirty interactive graphics terminals, the disk sector-at-a-time approach is the one that has the best chance of meeting requirements of high speed, network capabilities, and minimum mainframe system modification, all the while at reasonable cost. Data communication systems at the University of Michigan (line-at-a-time) and Purdue University (disk sector-at-a-time) are studied in detail. GRA

N75-28744# Utah Univ., Salt Lake City. Dept. of Computer Science.
A SUBDIVISION ALGORITHM FOR COMPUTER DISPLAY OF CURVED SURFACES Ph.D. Thesis
Edwin Catmull Dec. 1974 83 p refs
(Contracts DAHC15-73-C-0363; F30602-70-C-0300; ARPA Order 2477)
(AD-A004968; UTEC-CSC-74-133) Avail: NTIS CSCL 09/2

This report presents a method for producing computer shaded pictures of curved surfaces. Three-dimensional curved patches are used, as contrasted with conventional methods using polygons. The method subdivides a patch into successively smaller subpatches until a subpatch is as small as a raster-element, at which time it can be displayed. In general this method could be very time consuming because of the great number of subdivisions that must take place; however, there is at least one very useful class of patches - the bicubic patch - that can be subdivided very quickly. Pictures produced with the method accurately portray the shading and silhouette of curved surfaces. In addition, photographs can be mapped onto patches thus providing a means for putting texture on computer-generated pictures. GRA

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, and algorithms.

N75-28745 Illinois Univ., Urbana.
AN INTERACTIVE ANALYSIS SYSTEM FOR EXECUTION TIME ERRORS Ph.D. Thesis
Alan Mark Davis 1975 106 p
Avail: Univ. Microfilms Order No. 75-14100

The interactive analysis system for execution-time errors was designed for use in introductory computer programming courses. Its purpose is to provide students with the facility to have their execution-time errors analyzed so as to find the actual cause for those errors. A description is given of the algorithms and the implementation of a system which discusses both the execution error and the program in which it has occurred with the student with the goal of finding out what caused the error. The system satisfactorily locates the initial anomaly in the program and subsequently offers suggestions to the student about how to correct his program. The search for this anomaly is performed in a transparent fashion so as to also teach the student proper debugging techniques. The system described was implemented in the TUTOR programming language on the PLATO computer-assisted instruction system at the University of Illinois. Dissert. Abstr.

N75-28746 California Univ., Los Angeles.
A METHODOLOGY FOR DIGITAL SYSTEM DESIGN BASED ON STRUCTURAL AND FUNCTIONAL MODELING Ph.D. Thesis

Robert Irving Gardner, Jr. 1974 382 p
Avail: Univ. Microfilms Order No. 75-14053

An introduction to the concept of distinct structural and functional modeling for design, a review of the current state of digital system simulation languages, and a review of the current state of digital system design methodologies are reported. A new structural modeling language named SL-1 and two new functional modeling languages named GMB and FL-1 are defined and related to previous design modeling languages. A representation for modeling building block systems is defined in terms of the SL-1, GMB, and FL-1 modeling languages and in terms of a signal timing model. A procedure for designing systems is defined, incorporating both top-down and bottom-up design approaches. A principal objective of this procedure is to evaluate the system being designed throughout its synthesis in order to detect inadequate or incomplete designs as early in the design process as possible. A multi-access multi-processor shared-resource computer system is partially designed using the methodology. Dissert. Abstr.

N75-28747 Washington Univ., Seattle.
PROGRAM REFERENCE BEHAVIOR AND DYNAMIC MEMORY MANAGEMENT Ph.D. Thesis
Ram Kumar Gupta 1974 213 p
Avail: Univ. Microfilms Order No. 75-14919

The paging subsystem in a virtual memory computer system is a potential bottleneck and may cause substantial performance degradation if the memory management scheme is not properly selected. The selected paging algorithm must both allocate sufficient memory to each program and keep in this memory the program's locality set. Two dynamic paging algorithms (working set and page fault frequency) are discussed along with the LRU paging algorithm. Several models of program reference behavior which exhibit certain important observed characteristics of reference behavior (dynamic memory requirements, locality, and dynamics of locality), are developed and analyzed. A new model of program behavior, multi-partition locality model, is proposed and analyzed. System performance sensitivity to program and paging algorithm parameters was studied, and performance is evaluated in terms of space-time product, fault probability, and allocation size. Dissert. Abstr.

N75-28748*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A PROGRAM FOR CONTOURING RANDOMLY SPACED DATA
Roy W. Hamm (Computer Sciences Corp.), James F. Kibler, and W. Douglas Morris Jul. 1975 35 p refs
(NASA-TM-X-72749) Avail: NTIS HC $3.75 CSCL 09B

A description is given of a digital computer program which prepares contour plots of three dimensional data. The contouring technique uses a triangulation procedure. As presently configured, the program can accept up to 56,000 randomly spaced data points, although the required computer resources may be prohibitive. However, with relatively minor internal modifications, the program can handle essentially unlimited amounts of data. Up to 20 contouring intervals can be selected and contoured with either polygonal lines or smooth curves. Sample cases are illustrated. A general description of the main program and primary level subroutines is included to permit simple modifications of the program. Author

N75-28749*# Environmental Research and Technology, Inc., Concord, Mass.
COMPUTER PROGRAM COMPATIBLE WITH A LASER NEPHELOMETER Final Report, 20 May 1974 - 20 May 1975
Robert M. Paroskie, Henry H. Blau, Jr., and John C. Blinn, III Jun. 1975 29 p
(Contract NAS5-20496)
(NASA-CR-143816; ERT-P-821) Avail: NTIS HC $3.75 CSCL 09B

The laser nephelometer data system was updated to provide magnetic tape recording of data, and real time or near real time processing of data to provide particle size distribution and liquid water content. Digital circuits were provided to interface the laser nephelometer to a Data General Nova 1200 minicomputer. Communications are via a teletypewriter. A dual Linc Magnetic Tape System is used for program storage and data recording. Operational programs utilize the Data General Real-Time Operating System (RTOS) and the ERT AIRMAP Real-Time Operating System (ARTS). The programs provide for acquiring data from the laser nephelometer, acquiring data from auxiliary sources, keeping time, performing real time calculations, recording data and communicating with the teletypewriter. Author

N75-28750# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
AN ALGORITHM FOR THE INFERENCE OF TREE GRAMMARS Annual Report, 1 Jan. - 31 Dec. 1974
R. C. Gonzalez, M. G. Thomason, and J. J. Edwards Dec. 1974 92 p refs
(Contract N00014-71-A-0121-0005; NR Proj. 215-228)
(AD-A005326; TR-EE/CS-74-20) Avail: NTIS CSCL 09/2

This report presents an algorithm for the inference of tree grammars and its application to pattern recognition. The algorithm takes each sample tree of a pattern class and expresses it as a set of expansive productions capable of generating only that sample tree. The procedure is then generalized by making combinations of nonterminals within each set based on the properties of self embedding, regularity and equivalence. GRA

N75-28751# Stanford Univ., Calif. Dept. of Computer Science.
AUTOMATIC PROGRAM VERIFICATION. 2: VERIFYING PROGRAMS BY ALGEBRAIC AND LOGICAL REDUCTION
Norihisa Suzuki Dec. 1974 32 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A005412; SU-STAN-CS-74-473; SU-AIM-255) Avail: NTIS CSCL 09/2

Methods for verifying programs written in a higher level programming language are devised and implemented. The system can verify programs written in a subset of PASCAL, which may have data structures and control structures such as WHILE, REPEAT, FOR, PROCEDURE, FUNCTION and COROUTINE. The process of creation of verification conditions is an extension of the work done by Igarashi, London and Luckham which is based on the deductive theory by Hoare. Verification conditions are proved using specialized simplification and proof techniques, which consist of an arithmetic simplifier, equality replacement rules, fast algorithm for simplifying formulas using propositional truth value evaluation, and a depth first proof search process. The basis of deduction mechanism used in this prover is Gentzen-type formal system. Several sorting programs including Floyd's TREESORT3 and Hoare's FIND are verified. It is shown that the resulting array is not only well-ordered but also a permutation of the input array. GRA

N75-28752# Stanford Univ., Calif. Dept. of Computer Science.
FORMAL SEMATICS OF LISP WITH APPLICATIONS TO PROGRAM CORRECTNESS
Malcolm C. Newey Jan. 1975 189 p refs
(Contract DAHC15-73-C-0435; ARPA Order 2494)
(AD-A005413; SU-STAN-CS-75-475; SU-AIM-257) Avail: NTIS CSCL 09/2

Described are some experiments in the formalization of the LISP programming language using LCF (Logic for Computable Functions). The bulk of each experiment was concerned with applying the formalization to proofs of correctness of some interesting LISP functions using Milner's mechanized version of LCF. GRA

N75-28753# Case Western Reserve Univ., Cleveland, Ohio. Dept. of Operations Research.
INTEGER PROGRAMMING BY GROUP THEORY: SOME COMPUTATIONAL RESULTS
Harvey M. Salkin and Susumu Morito Jan. 1975 37 p refs
(Contract N00014-67-A-0404-0010)
(AD-A005002; TM-341) Avail: NTIS CSCL 12/2

A group theoretic algorithm for the integer program has been computer programmed and tested. It basically consists of a linear programming algorithm, a routine which converts the (relaxed) integer program to a group minimization problem (over the fractional column group or the isomorphic factor group attained via Smith's Normal Form), solving the group problem

by dynamic programming or by a shortest path algorithm, and when necessary, uses a branch and bound procedure. Details and computational results are given. Future work regarding other computational strategies available to group theoretic algorithms is also included. GRA

N75-28754# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
DIGITAL COMPUTER PROGRAM FOR THE DETERMINATION OF MODIFIED Z-TRANSFORMS WITH W-PLANE TRANSFORMATION
Edward E. Herbert and Bettye Rogerson 1 Dec. 1974 75 p refs
(DA Proj. 1M2-63306-D-077)
(AD-A005585; RG-75-20) Avail: NTIS CSCL 12/1

In the analysis of sampled data control systems containing transport lags due to computational delay of the controller and/or the actuator mechanism, the modified Z-transforms are frequently used. This computer program breaks down the Laplace transform transfer function of the system into a sum of partial fractions and computes the modified Z-transform of each term. Each term is mapped into the W-plane by the bilinear transformation $Z=(1+w)/(1-w)$. This technique allows the control system designer to use conventional classical methods of continuous systems on the W-plane transfer functions. The poles and zeroes of the W-plane are mapped back into Z by inverse transformations. The program listing is included. Author (GRA)

N75-28755# Letterman Army Inst. of Research, San Francisco, Calif.
PROGRAM POSTHOC: BALANCED ONE-WAY INDEPENDENT-GROUPS OR REPEATED-MEASURES ANALYSIS OF VARIANCE WITH POST-HOC DUNNETT, NEWMAN-KEULS OR SCHEFFE MEAN COMPARISONS
Ray T. Sterner, James T. Wheeler, and Lavern F. Krabill Nov. 1974 61 p refs
(DA Proj. 3A1-61101-A-9C)
(AD-A005228; LAIR-25) Avail: NTIS CSCL 12/1

User instructions for the operation of a FORTRAN 4 program (i.e., POSTHOC) to compute balanced one-way independent-groups or repeated-measures analysis of variance and either Dunnett, Newman-Keuls or Scheffe post-hoc means comparisons are described. GRA

N75-28756# Massachusetts Inst. of Tech., Cambridge.
PROJECT MAC Progress Report, Jun. - Dec. 1973
E. Fredkin Dec. 1974 135 p refs
(Contract N00014-70-A-0362-0006)
(AD-A004966; PR-11) Avail: NTIS CSCL 09/2

Research work is reported in: automatic computer programming, robot engineering, mathematical modeling, programming technology, and computer systems and networks. G.G.

N75-28757# Naval Research Lab., Washington, D.C.
ON THE NEED FOR FEWER RESTRICTIONS IN CHANGING COMPILE-TIME ENVIRONMENTS Interim Report
David L. Parnas, John E. Shore, and W. David Elliott 10 Jan. 1975 12 p refs
(XF21241021; RF21222401)
(AD-A004953; NRL-7847) Avail: NTIS CSCL 09/2

To encourage the compartmentalization of information and at the same time to allow efficient code generation, the authors propose the relaxation of present restrictions on changes in the compile-time environment. The proposal is an attempt to make the implementation of the program organization and specification techniques described in other papers practical. In contrast to other work on languages for structured programming, the authors do not address mechanisms for using this feature to implement any particular type of abstraction (e.g. abstract data types). The concern is only with returning to the programmer a capability he needs to write well-structured programs. Other mechanisms are left for higher levels. GRA

62 COMPUTER SYSTEMS

Includes computer networks.

N75-28758 Missouri Univ., Rolla.
DYNAMICAL MODELING OF COMPUTING SYSTEMS AND ITS APPLICATIONS TO OTHER SYSTEMS Ph.D. Thesis
Heh-Ching Li 1974 166 p
Avail: Univ. Microfilms Order No. 75-15833

A continuous linear dynamical state space modeling procedure is presented for both discrete and continuous systems in terms of equivalent electrical networks. This procedure is illustrated in detail for two systems: a small general purpose computer and a recreational park system. Necessary dimensional transformations for these systems and their electrical model are discussed: it is determined which identify significant system parameters and the relationships between these parameters. The model for the small general purpose computer provides the mathematical capability for performance evaluation of the entire computing system characteristics. An innovative matrix approach is used to present the topological representations of software, hardware and the interaction of the software, hardware and the interaction of the software and hardware. The output of this computing system model is the turnaround time of each instruction cycle and/or each data transfer. The output of the recreational park system modeling is the number of campers who wish to attend the park system. Dissert. Abstr.

N75-28759 Southern Methodist Univ., Dallas, Tex.
PICTURE-SYSTEM MODELS AND COMPUTER SYSTEM DESIGN Ph.D. Thesis
Portia Isaagson 1974 331 p
Avail: Univ. Microfilms Order No. 75-13929

Picture-system models, along with PS which automates their production, are useful in defining, communicating, and simulating computer system designs (especially in the early design stages). Picture-system models are defined and an implemented system called PS is described which generates models from a description of a computer system as a structure of finite-state components. The PS system also does an analysis on the state-transition graph of the subject computer system which detects design problems such as deadlocks, looping, and races. Several example picture-system models were developed, including: a channel-to-channel computer interface, digital logic circuits, and examples of process synchronization. These examples demonstrate the versatility of picture-system models and point the way towards several areas for future research. Dissert. Abstr.

63 CYBERNETICS

Includes feedback and control theory.

For related information see also *54 Man/System Technology and Life Support.*

N75-28760# Maryland Univ., College Park. Computer Science Center.
REGION EXTRACTION BY AVERAGING AND THRESHOLDING
Larry S. Davis, Azriel Rosenfeld, and Joan S. Weszka Jun. 1974 23 p refs
(Contract F44620-72-C-0062; AF Proj. 9769)
(AD-A005320; TR-311; AFOSR-75-0200TR) Avail: NTIS CSCL 09/2

Regions in a picture that differ texturally from their surroundings can often be extracted by (1) applying a local operation to every point of the picture, (2) averaging the results, and (3) thresholding. This approach will usually not work if there are too many differently textured regions present, since the average for one type of region may then be indistinguishable from the average resulting from a mixture of two other types that adjoin. The amount of averaging that should be used depends on the coarseness of the texture. An approach to choosing this amount automatically was investigated, but the results were not as good as those obtained with a fixed, high degree of averaging. GRA

N75-28761# Maryland Univ., College Park. Computer Science Center.
THRESHOLD SELECTION TECHNIQUES, 3 Interim Report
H. H. Yen Feb. 1974 19 p refs
(Contract F44620-72-C-0062; AF Proj. 9769)

(AD-A005319; TR-294; AFOSR-75-0197TR) Avail: NTIS CSCL 09/2

This report describes the implementation of a standard technique for selecting a picture segmentation threshold by examining the gray level histogram of the picture. The histogram is least-squares approximated by a sum of two or more Gaussians, and the maximum-likelihood threshold between these is determined. Results are shown for several different types of pictures, including handwriting, chromosomes, and cloud cover. GRA

N75-28762# Michigan Univ., Ann Arbor. Information and Control Engineering.

STATIONARY POINT PROCESSES AND APPLICATIONS TO COMMUNICATIONS AND LOGISTIC SYSTEMS Final Report, 1 Jun. 1970 - 30 Sep. 1974

Frederick J. Beutler Jan. 1975 10 p refs

(Grant AF-AFOSR-1920-70; AF Proj. 9769)

(AD-A005720; AFOSR-75-0173TR) Avail: NTIS CSCL 12/1

The final scientific report summarizes the research activities under the Grant for the period 1 Jun. 70 through 30 Sep. 74. Thirteen research articles were prepared. They concern the statistics of random pulse processes, the almost sure stability of randomly sampled systems, an almost sure exponential bound for outputs of a nonlinear autonomous control system with stochastic operator systems with applications to randomly sampled control, two discrete-time system stability concepts and supermartingales, the recovery of randomly sampled signals by simple interpolators, the operator pseudoinverse in control and systems identifications, counting processes and integrated conditional rates with a martingale approach with applications to detection, counting processes and martingales, conditional probability generating functions of counting processes, and recursive integral equations for the detection of counting processes. GRA

N75-28763# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.

SIGNAL SELECTION AT LOW SIGNAL-TO-NOISE RATIO

C. H. Chen 24 Oct. 1974 15 p refs

(Grant AF-AFOSR-2119-71; AF Proj. 9769)

(AD-A005728; EE-74-4; AFOSR-75-0276TR) Avail: NTIS CSCL 09/4

This paper is concerned with the use of distance measures such as the divergence, Bhattacharyya distance, mutual information for signal selection particularly at low signal-to-noise ratio. Although signal selection is more difficult at low signal-to-noise, these measures are generally effective. However, they do not normally provide the same choice of signals. The problem areas considered are the detection of known signal in additive Gaussian noise, noncoherent detection of signal of unknown amplitude and phase, detection of Poisson processes with unequal mean value functions, diversity reception, and radar parameter estimation. GRA

N75-28764# Southeastern Massachusetts Univ., North Dartmouth. Dept. of Electrical Engineering.

COMMENTS ON INFORMATION AND DISTANCE MEASURES, ERROR BOUNDS, AND FEATURE SUBSET SELECTION

C. H. Chen 14 Jan. 1975 14 p refs

(Grant AF-AFOSR-2119-71; AF Proj. 9769)

(AD-A005727; EE-75-1; AFOSR-75-0194TR) Avail: NTIS CSCL 09/4

A recent paper by L. Kanal provides a fairly complete list of information and distance measures and error bounds. This paper discusses the major problem areas with these measures, provides a more extensive list of measures including the newly proposed average conditional cubic entropy and suggests methods of approach for the unresolved problems. The topic of feature subset selection is also examined. GRA

N75-28765# Illinois Univ., Urbana. Coordinated Science Lab.

MARKOV GAP MODEL WITH MEMORY FOR DIGITAL CHANNELS

Pramod Kumar Varshney Oct. 1974 56 p refs

(Contract DAAB07-72-C-0259)

(AD-A004982; R-665; UILU-ENG-74-2231) Avail: NTIS CSCL 09/4

The volumes of information to be transmitted in digital communications have increased tremendously in recent years, necessitating the use of computers at the receiver for error control. For accurate transmission of information many codes have been developed with error correcting capabilities. But a code that minimizes the probability of error for a channel depends on the properties of the channel. For instance, a code that minimizes the probability of error for a channel in which the errors occur randomly does not, in general, minimize the probability of error for a channel in which the errors occur in bursts. Therefore, one needs to know the statistical properties of the channel before an appropriate error correcting code could be selected. A mathematical model of the channel is used to represent the necessary error statistics of the channel. The model represents the input-output characteristics of the channel and does not attempt to model the actual physical process causing the errors. GRA

N75-28766# Maryland Univ., College Park. Computer Science Center.

DETECTION OF STEP EDGES IN NOISY ONE-DIMENSIONAL DATA

Larry S. Davis and Azriel Rosenfeld May 1974 34 p refs

(Contract F44620-72-C-0062; AF Proj. 9769)

(AD-A005694; TR-303; AFOSR-75-0199TR) Avail: NTIS CSCL 09/2

A method of detecting step edges in noisy one-dimensional input data is described. The method involves examination of differences in average gray level over ranges of positions and sizes. Unlike previously described methods, it remains reliable when edges occur close to one another. GRA

N75-28767# Maryland Univ., College Park. Computer Science Center.

PICTURE PROCESSING, 1974

Azriel Rosenfeld Jan. 1975 73 p refs

(Contract N00014-75-C-0286)

(AD-A004974; TR-346) Avail: NTIS CSCL 09/2

Developments in the field of picture processing by computer during 1974 are surveyed, and a bibliography of nearly 350 references is given. The topics covered include picture compression; image enhancement and reconstruction; picture matching, edge and curve detection; picture processing implementations; pictorial pattern recognition; picture properties; picture parts and picture description; picture automata and grammars. GRA

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N75-28768 Maryland Univ., College Park.

ANALYTICAL SOLUTIONS OF THE TWO-VECTOR BOLTZMANN EQUATION IN NONPLANER GEOMETRIES Ph.D. Thesis

Ming-Teh HSU 1974 137 p

Avail: Univ. Microfilms Order No. 75-15777

Analytical solutions to the two-group neutron transport equation were obtained in one-dimensional spherical and cylindrical geometries, utilizing a procedure which transforms the integral form of the transport equation into an integro-differential equation which is amenable to solutions using Case's singular eigenfunction expansion method. The explicit form of the two-group integral equation in two-region spheres was developed. The generalized equation was reduced to the specific formulation for single region spheres and the spherical Milne problem. The transform procedure was applied to the single region form which yields the integro-differential equation found in slab geometry. The known eigenfunctions and their properties were utilized to solve the infinite medium spherical Green's function problem. The two-group infinite medium Green's function in cylindrical geometry is solved and the procedure for solving the two-group cylindrical critical problem is indicated. Dissert. Abstr.

N75-28769 Virginia Polytechnic Inst. and State Univ., Blacksburg.

AN OPTIMUM IDEALIZATION IN FINITE-ELEMENT METHOD FOR A TWO-GROUP NEUTRON-DIFFUSION

PROBLEM Ph.D. Thesis
Farouk M. Eltawila 1974 125 p
Avail: Univ. Microfilms Order No. 75-15872

The application of the finite-element method to the solution of the two-group neutron-diffusion equations by approximating the solution in piece-wise polynomial space is compared for different mesh sizes. The results show that the thermal flux shape is distorted and is dependent on the size of the mesh used. An algorithm based on the Fletcher and Powell optimization method was used to determine the mesh size which results in the best approximate solution. This optimum mesh selection approach permits the use of a coarse mesh, which can be refined in areas where it is needed. Numerical examples, which confirm the accuracy and demonstrate the sensitivity of the flux shape to the element size used, are presented.
Dissert. Abstr.

N75-28770 California Univ., Los Angeles.
IDENTIFICATION OF CONTINUOUS TIME DYNAMICAL SYSTEMS WITH UNKNOWN NOISE COVARIANCE Ph.D. Thesis
Arunabha Bagchi 1975 82 p
Avail: Univ. Microfilms Order No. 75-14073

In identifying parameters of a continuous-time dynamical system, the difficulty arises when the observation noise covariance is unknown. This problem is solved in the case of a linear time invariant system with white noise affecting additively both the state and the observation. Likelihood functional cannot be obtained when the observation noise covariance is unknown. A similar procedure, however, works and the estimates are obtained by finding roots of an appropriate functional. It is shown that the estimates obtained are weakly consistent. In the special case of no noise in the state, it is further shown that similar procedure yields estimates that are strongly consistent. Dissert. Abstr.

N75-28771 Syracuse Univ., N.Y.
GENERALIZATIONS OF THE BANACH-SAKS PROPERTY Ph.D. Thesis
Arthur Dennis Shindhelm 1974 113 p
Avail: Univ. Microfilms Order No. 75-14024

The Banach-Saks property (property B.S.) is defined: every bounded sequence contains a subsequence whose (C,1) means converge strongly. The word 'bounded' was replaced by 'weakly convergent', and the weak Banach-Saks property (property (B.S.) prime) was obtained. Nontrivial background material is presented along with examples of Banach spaces which have either Banach-Saks property B.S. or B.S. prime, and examples which do not possess these properties. Generalizations of property B.S. obtained by replacing (C,1) summability by more general summability methods are discussed. Results relating these generalizations of property B.S. to the concept of reflexivity are presented. Dissert. Abstr.

N75-28772 Yale Univ., New Haven, Conn.
COMPLETE REDUCIBILITY OF RESTRICTED REPRESENTATIONS OF CLASSICAL LIE ALGEBRAS Ph.D. Thesis
Timo Juhani Neuvonen 1974 65 p
Avail: Univ. Microfilms Order No. 75-15365

A necessary and sufficient condition for a restricted representation of a classical Lie algebra to be completely reducible is derived. This is done using modules produced from parabolic subalgebras. As a corollary, generators for the radical of the u-algebra of a classical Lie algebra of type A1 are obtained. This together with our criterion can be used to generate a number of new elements in the radical of the u-algebra of any classical Lie algebra. A completely reducible representation of a classical Lie algebra g need not be completely reducible as a representation for some subalgebra. Some properties of modules induced from parabolic subalgebras are derived, using the duality between induced and produced modules. Dissert. Abstr.

N75-28773 Texas A&M Univ., College Station.
ON THE ENDOMORPHISM MONOIDS OF BOOLEAN ALGEBRAS AND DISTRIBUTIVE LATTICES Ph.D. Thesis
Ponnammal Natarajan 1974 83 p
Avail: Univ. Microfilms Order No. 75-15054

It is a known fact that the automorphism group does not characterize a Boolean algebra. New examples to verify the above fact are obtained. By considering the finite cofinite Boolean algebra on an infinite set X, and its generalizations, examples of nonisomorphic Boolean algebras are also obtained in which the automorphism groups are isomorphic. It is shown that there exist an infinite number of nonisomorphic Boolean algebras with automorphism groups anti-isomorphic to S(X), the symmetric group of transformations on a set X. Dissert. Abstr.

N75-28774 City Univ. of New York.
GRAPH REALIZABILITY AND CONNECTIVITY OF MATROIDS Ph.D. Thesis
Tamotsu Inukai 1975 231 p
Avail: Univ. Microfilms Order No. 75-13636

A matroid generalizes a matrix, a graph, and a vector space, and matroid theory is an axiomatic study of independence structures in these mathematical systems. Matroid structure was investigated along with matroid connectivity, graph decomposition, graph realizability, maximal bipartite and maximal Euler minors, and Whitney connectivity of matroids. Dissert. Abstr.

N75-28775 Virginia Polytechnic Inst. and State Univ., Blacksburg.
SOME EXAMPLES OF COMPROMISES BETWEEN BAYESIAN AND NON-BAYESIAN STATISTICAL METHODS Ph.D. Thesis
John Marvin Rogers 1975 137 p
Avail: Univ. Microfilms Order No. 75-15882

It was shown that when a sample is taken from a unimodal distribution, symmetric about a mean mu, the posterior expectation of mu is a shrunken estimator so long as the prior distribution is unimodal and symmetric about the initial guess. Necessary and sufficient conditions on the distribution from which the sample is taken, are given, such that the posterior expectation of a parameter is a monotonic increasing function of a sufficient statistic for the parameter. Type 2 maximum likelihood, was investigated in the cases of inference about the mean of a normal distribution when the prior was either of normal or Cauchy form. The analysis necessary to facilitate use of a prior distribution of Cauchy form was completed. A type 2 maximum likelihood estimator appears to be preferable to the usual maximum likelihood estimator so long as there is some prior information concerning the parameter to be estimated. Dissert. Abstr.

N75-28776 Oklahoma Univ., Norman.
OSCILLATION OF HIGHER ORDER DELAY AND FUNCTIONAL DIFFERENTIAL EQUATIONS Ph.D. Thesis
Tsai-Sheng Liu 1974 68 p
Avail: Univ. Microfilms Order No. 75-15262

The ordinary differential equations considered are n-th order functional, including those with deviating arguments. Certain criteria for oscillation and asymptotic behavior of solutions are given. Some results for second order delay and functional differential equations are extended to higher order equations. Special consideration is given to differential inequalities of n-th order and to n-th order damped nonlinear differential equations.
Dissert. Abstr.

N75-28777 Missouri Univ., Rolla.
TCHEBYCHEFF APPROXIMATION ON A DISCRETE POINT SET: ALGORITHMS OLD AND NEW Ph.D. Thesis
William Edward McBride 1973 99 p
Avail: Univ. Microfilms Order No. 75-15838

Several linear and nonlinear algorithms for solving the discrete Tchebycheff problem are compared in this study. The Lawson algorithm is compared with two methods of linear Tchebycheff approximation. A new acceleration scheme for the Lawson algorithm is introduced and its performance was tested with an already existing acceleration technique. The new version is found to be better than the previous one but not as effective as the traditional exchange method. A nonlinear version of Lawson's algorithm is proposed for the solution of problems having approximating functions which are varisolvent. Some linear theorems of Lawson are extended to the nonlinear case. A modification of Osborne and Watson's nonlinear method is introduced and tested on five problems. This new technique improves the efficiency, particularly for larger problems.
Dissert. Abstr.

N75-28778 Syracuse Univ., N.Y.
BOUNDED VARIATION AND ITS GENERALIZATIONS Ph.D. Thesis
David Engles 1974 203 p
Avail: Univ. Microfilms Order No. 75-13979

This is an expository dissertation concerning the concepts of bounded variation (BV) and absolute continuity (AC). The classical results in this area of real analysis, including those due to Jordan, Lebesgue, Banach and de la Vallee Poussin, are presented. The relationship between BV and AC is examined and generalizations of BV and AC are considered. The works of Jeffery, Bhakta, and Chakrabarty on bounded omega-variations, of Russel on bounded k-variations, of Wiener, Young, and Love on bounded p-variation, of Young, Musielak, and Orlicz on bounded phi-variation, and of Waterman on bounded Lambda variation are presented. The Fourier series deals mainly with extensions of the Dirichlet-Jordan theorem. Dissert. Abstr.

N75-28779 Washington Univ., Seattle.
GLOBAL SOLUTION TO THE INDEFINITE QUADRATIC PROGRAMMING PROBLEM Ph.D. Thesis
Paul Floyd Kough 1974 95 p
Avail: Univ. Microfilms Order No. 75-14929

The global solution to the indefinite quadratic problem is obtained via a generalized Bender cut procedure. The Bender cut method iteratively adds cuts to a master problem. Maximizing the master problem is shown to be equivalent to maximizing several convex quadratic subproblems. Each cut creates a subproblem. This decomposition provides for the solution of the master problem by an implicit enumeration algorithm combined with Tui cuts. In order to accelerate convergence only a subset of the subproblems is solved. The formal method is then combined with the accelerated procedure to insure convergence to the global optimum. These methods are epsilon-finite. That is, given any epsilon, in a finite number of steps a point is located and recognized to have an objective value within epsilon of the global maximum. Dissert. Abstr.

N75-28780 University of Southern Calif., Los Angeles.
INTERPOLATIVE SPLINE FILTERS Ph.D. Thesis
Hussein Mohamed Youssef 1975 99 p
Avail: Univ. Microfilms Order No. 75-15599

An optimum nonlinear filter is realized by sequentially updating the spline coefficients of the relevant conditional distribution. The nonlinear filtering problem considered is that of phase demodulation with a two dimensional phase process model. Speed and accuracy comparison of spline realization with other realizations such as Fourier filter and point mass is provided. A multidimensional hyperbolic sine and casine and polynomial spline basis are generated by a tensor product of one-dimensional bases. Generalized boundary conditions are implemented along with interpolation and continuity conditions of second order at each mesh point of the spline. A tension factor was introduced into the spline elements to preserve the positivity while maintaining enough smoothness in the fitting with a minimum of grid points. The matrix is the Kronecker product of two tri-diagonal matrices each of which is inverted explicitly. A review of some timing results for various methods of tri-diagonal matrix inversion is provided. Dissert. Abstr.

N75-28781 Utah State Univ., Logan.
COMPARISON OF BIAS IN BOTH ORTHOGONAL AND ORDINARY LEAST SQUARES REGRESSION COEFFICIENTS IN A TWO VARIATE REGRESSION MODEL WHEN BOTH VARIATES ARE SUBJECT TO ERROR OF OBSERVATION Ph.D. Thesis
Shah Wali Khan 1975 234 p
Avail: Univ. Microfilms Order No. 75-14447

It is shown that whenever there is an error of observation in the independent variable, it causes a bias in the regression coefficient due to the fact that one of the assumptions of the ordinary least squares method (that the error term is uncorrelated with the independent variable) is violated. The bias ratio equations were developed and with the identical error ratio assumption, the bias ratio equations reduce to simplified forms and do not involve the parameter of regression but are functions of correlation coefficients. The limiting value for the bias ratio in both orthogonal and least squares regression was derived. The comparison between orthogonal regression coefficient and ordinary least squares regression coefficient was made by two methods: simulation procedure and analytical procedure. With uncorrelated error of observation among themselves and also with the true variables, both the orthogonal and ordinary least squares regression coefficients were simulated, and the normal distribution of these regression coefficients was tested. Dissert. Abstr.

N75-28782 Virginia Polytechnic Inst. and State Univ., Blacksburg.
MATHEMATICAL MODELING AND STRUCTURAL BEHAVIOR Ph.D. Thesis
Arnold Eugene Somers 1975 200 p
Avail: Univ. Microfilms Order No. 75-15883

The objective was to provide meaning, clarity, and organization to the concept of mathematical modeling as it is used in the empirical sciences. In addition, the details of a mathematical model were presented from the field of structural mechanics. The formal structure of mathematical theories has provided the basis for the organization of physical theories as well as the fundamental meaning of a model of a theory. An important distinction between a mathematical theory and a physical theory is that the physical theory must have some meaning in the real world, and a particular model of a physical theory represents the behavior of a specific real object. The basic components of a model of a physical theory are defined in a general sense. These components include the basic variables, the basis for the relationships between the variables, the properties of the model, the solution, and the validity and limitations. In addition, a guide to model development was presented. Dissert. Abstr.

N75-28783 Tulsa Univ., Okla.
GAS RESERVOIR SIMULATION BY ALTERNATING DIRECTION GALERKIN METHODS Ph.D. Thesis
Roland Lance Farrar 1975 92 p
Avail: Univ. Microfilms Order No. 75-15931

An Alternating Direction Galerkin (ADG) method was developed. This technique offers the advantage that multidimensional problems can be reduced to a collection of one dimensional problems. Multivariate Lagrangian interpolation was employed to represent the nonlinear coefficients in the partial differential equations. This obviated the necessity of quadratures entirely. These novel approaches were employed in the construction of a three dimensional gas reservoir simulator capable of treating anisotropic, heterogeneous reservoir problems with a multiplicity of wells. The results of the ADG solution compared to two problems having analytic solutions are presented. Results from five reservoir problems are compared to similar results from a comparable finite difference model. These results show that the ADG model is competitive with the finite difference simulator for two dimensional problems having coarse grids.
Dissert. Abstr.

N75-28784 Oklahoma State Univ., Stillwater.
THE BEST ESTIMATE OF A MULTIVARIATE NORMAL DISTRIBUTION Ph.D. Thesis
Hong-i Yang 1974 67 p
Avail: Univ. Microfilms Order No. 75-8919

The estimate of the probability F (h sub 1,..., h sub p) of a p-variate normal distribution by the application of the Rao-Blackwell and Lehmann-Scheffe theorems was studied. The best estimates of the probability F(h,k) of a bivariate normal distribution for six different cases of the parameter space were obtained. The best estimate of the probability F(h sub 1,..., h sub p) of a p-variate normal distribution was obtained for unknown mean vector and unknown variance-covariance matrix. Dissert. Abstr.

N75-28785 Texas A&M Research Foundation, College Station.
NONPARAMETRIC METHODS IN MULTIVARIATE DISCRIMINANT ANALYSIS Ph.D. Thesis
Kris K. Moore 1974 85 p
Avail: Univ. Microfilms Order No. 75-15051

Nonparametric analogs to Wilks' lambda, Pillai's V, and Hotel ling's T(2) sub 0 are proposed as multivariate discriminators. Small sample distributions for the proposed statistics are generated by a method based on ranks. Simulation studies are made comparing parametric versus nonparametric methods on the basis of probability of misclassification under an assumption of normality of the data, and also when the assumption of

normality of the data is violated. An investigation is made of methods for evaluating the relative discriminatory power of subsets of variables in a management discriminant analysis problem. Seven different selection methods are compared for both the parametric approach and the nonparametric method of ranking the data.
Dissert. Abstr.

N75-28786 North Carolina State Univ., Raleigh.
NON-LINEAR ESTIMATION BY PARABOLIC APPROXIMATION Ph.D. Thesis
Robert Edward Mason 1971 117 p
Avail: Univ. Microfilms Order No. 75-15909

A general method for estimating values of nonlinearly arranged parameters and their associated variances was developed. Parameter estimates were obtained such that the sum of squared deviations between observed points and those predicted by the model is minimized. The method developed involves approximating the surface generated by the objective function to be minimized by a parabolic surface. Arbitrary points along the parameter axes, evaluated on the real surface, were used to solve for the minimum of a parabolic surface at successive iterations. The region of the surface in which the points are evaluated is reduced at successive iterations, and each parameter axis is introduced singly, in a hierarchical manner. Variance estimates are coincidentally computed. The method was tested using a variety of objective functions taken from the literature, involving minimization as such, and solving nonlinear simultaneous equations, as well as least squares applications. Dissert. Abstr.

N75-28787 Texas A&M Univ., College Station.
ALGORITHM FOR THE COMPUTATION OF THE COEFFICIENTS OF POWERS OF POLYNOMINALS Ph.D. Thesis
Grace Yun-Loh(Yeh) Chen 1974 84 p
Avail: Univ. Microfilms Order No. 75-15017

One of the approaches to determine the global maximum of a multivariate function f(x) within a feasible region R in the Euclidean n-space is based on the evaluation of the so-called functional moments of f(x). Algorithms accomplishing this task in three special cases are discussed. The first case arises when f(x) is a multivariate polynomial and R is the n dimensional hypercube. In the second case, f(x) is a multivariate expansion into trigonometric functions and region R is the hypercube. A third case is considered where f(x) is given by a multivariate polar expansion and R is a smooth convex region in the sense that the distance from an origin in the interior of R to the boundary is a low degree trigonometric expansion in the space angles. The application of I sub k to nonconvex programming is not discussed but a number of generalizations of the above problem, useful in mathematical programming, are treated.
Dissert. Abstr.

N75-28788 British Library Lending Div., Boston Spa (England).
STATISTICAL LINEARIZATION OF COMPLEX INDICES
F. N. Taraborin, V. I. Solovev, V. P. Avdeev, V. S. Krapivkin, and Zh. E. Sleptsov [1974] 9 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 8, 1974 p 159-162
(BLL-M-25062-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

A method is considered for the statistical linearization of complex indices with the aim of reducing the influence of errors in the monitoring of the parameters involved. Formulas are given for expanding these indices into a Taylor series with correction of coefficients on the basis of a comparison of signal dispersions and the measurement errors. Author

N75-28789# Technische Hogeschool, Delft (Netherlands).
APPROXIMATION OF UNBOUNDED FUNCTIONS WITH LINEAR POSITIVE OPERATORS Ph.D. Thesis
Ram Kishore Singh Rathoré 27 Nov. 1974 161 p refs
Avail: NTIS HC $6.25

Classes of unbounded functions, members of which may be approximated with the use of a given sequence of linear positive operators, were determined. Results were obtained which can be applied to functions having an unboundedness of a higher order and can be generalized for other test functions forming a Chebyshev system. Bounding and W-functions are discussed along with Bernstein polynomials. M.J.S.

N75-28790# Technische Universitaet, Munich (West Germany).
EFFECTIVE INTERACTIONS AND THEIR SYMMETRICAL PROPERTIES Ph.D. Thesis [EFFEKTIVE WECHSELWIRKUNGEN UND IHRE SYMMETRIEEIGENSCHAFTEN]
Richard Bauer 26 Sep. 1974 81 p refs In GERMAN
Avail: NTIS HC $4.75

The finite Fenni theory is used to develop symmetry conditions for effective nuclei interactions that reduce the number of parameters contained in magnetic dipole- and electrical quadrupole-moments, charge distribution, electromagnetic transfers or moments of collective states. Comparison between measured and calculated values for about 90 electromagnetic nuclei properties in the vicinity of lead show good agreement.
Transl. by G.G.

N75-28791# Naval Postgraduate School, Monterey, Calif.
SOME ALTERNATIVE METHODS TO STEPWISE REGRESSION FOR THE SCREENING OF VARIABLES M.S. Thesis
Dennis George Lambell Dec. 1974 55 p refs
(AD-A005470) Avail: NTIS CSCL 12/1

This paper addresses the problem of screening potential variables for entrance in a linear multiple regression setting. The purpose of the work presented here is to propose two screening methods, both of which have roots in principle component analysis, and which evaluate a combination of variables in an efficient enough manner so that enumeration of all combinations is feasible even when the number of potential variables is quite large. Using the square of the multiple correlation coefficient as the criterion, the selections made by these methods in several test cases are evaluated, and compared with the selections made by the methods of total enumeration and stepwise regression. The paper concludes with overall evaluations of the two methods and suggests directions for further study. GRA

N75-28792# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
GRAPHS WITH DEGREES FROM PRESCRIBED INTERVALS
Michael Koren Jan. 1975 16 p refs
(Contract N00014-67-A-0077-0014)
(AD-A005418; TR-248) Avail: NTIS CSCL 12/1

Necessary and sufficient conditions for the existence of simple graphs with degrees from prescribed intervals, are given. GRA

N75-28793# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
VON NEUMANN-MORGENSTERN SOLUTIONS
William F. Lucas Jan. 1975 11 p refs
(Contract N00014-67-A-0077-0014; Grant NSF GP-32314)
(AD-A005417; TR-246) Avail: NTIS CSCL 12/2

This paper gives a very short introduction to the von Neumann-Morgenstern theory of solutions, or stable sets, for multiperson cooperative games in characteristic function, or coalition, form. It includes the basic definitions which describes the essential notions for their n-person cooperative model, and it gives a very brief indication with references of some known results plus the general nature of this theory. GRA

N75-28794# Naval Postgraduate School, Monterey, Calif.
RESPONSE OF NONLINEAR SYSTEMS TO UNUSUAL INPUTS M.S. Thesis
Jose Antonio Joglar Dec. 1974 181 p refs
(AD-A005473) Avail: NTIS CSCL 12/1

Handling nonlinear systems is not a simple task, especially if a computer is not available. Generally, although a precise result for every case would be preferable, an approximate solution is usually sufficient for most engineering solutions. R. Boxer and S. Thaler developed a technique presented in Proceedings of IRE that allow one to obtain the response of linear and nonlinear systems, without knowledge of the roots of the system characteristic equation. The aim of this work is to test this technique in obtaining the solution of several time varying linear equations and to produce a compute program that improves the solution accuracy and ease of use. GRA

N75-28795# Denver Research Inst., Colo. Div. of Mathematical Sciences.
ASYMPOTIC EXPANSIONS OF INTEGRAL TRANSFORMS

OF FUNCTIONS WITH LOGARITHMIC SINGULARITIES Final Report
Norman Bleistein Jan. 1975 38 p refs
(Contract N00014-67-A-0394-0005; NR Proj. 041-434)
(AD-A005421; MS-R-7503) Avail: NTIS CSCL 12/1

Asymptotic expansions of integral transforms of functions with logarithmic singularities are defined. The method is based on the Mellin transform technique developed by Handelsman and Lew. Examples included are LaPlace, Airy, Weber and Stieltjes transforms. GRA

N75-28796# Wyoming Univ., Laramie.
CONFIDENCE INTERVALS FOR THE DIFFERENCE OF TWO PROPORTIONS: SMALL SAMPLE SIZES
Lyman L. McDonald, Kenneth D. Neubauer, and Keren A. Meister Oct. 1974 125 p refs
(Contract N00014-70-A-0266-0010; NR Proj. 042-310)
(AD-A005644; Rept-2009; RP-44) Avail: NTIS CSCL 12/1

Confidence intervals, with confidence levels more than or equal to 90, 95 and 99 per cent are tabulated for the difference of two proportions under independent binomial sampling. All possible sample sizes up to and including 12 are considered, as well as selected cases for sample sizes from 13 to 15. The listing of a FORTRAN IV computer program is given which will generate confidence intervals for other cases. Author

N75-28797# Florida State Univ., Tallahassee. Dept. of Statistics.
PREDICTION FUNCTIONS AND MEAN-ESTIMATION FUNCTIONS FOR A TIME SERIES Interim Report
George Kimeldorf and Lawrence Peele Dec. 1974 26 p refs
(Grants AF-AFOSR-2581-74; DAHC04-74-G-0188)
(AD-A005729; FSU-TR-M325; AFOSR-75-0249TR; AFOSR-TR-42; USARO-D-TR-13) Avail: NTIS CSCL 12/1

A prediction function and a mean-estimation function are defined. For certain prediction and estimation problems, characterizations of these functions in terms of the covariance reproducing kernel Hilbert space are derived. A prediction problem of Kimeldorf and Wahba was extended to infinitely many observations; similarly, results allowing an infinite-dimensional mean space were obtained. Author

N75-28798# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
ON A COVERING PROBLEM FOR PARTIALLY SPECIFIED SWITCHING FUNCTIONS Interim Report
M. Schkolnick Dec. 1974 10 p ref
(Contract F44620-73-C-0074; ARPA Order 2466)
(AD-A005691; AFOSR-75-0195TR) Avail: NTIS CSCL 12/1

The author considers the problem of finding the minimum number K(n,c) of total switching functions of n variables necessary to cover the set of all switching functions which are specified in at most c positions. Found were an exact solution of K(n,2) and an upper bound for K(n,c) which is better than a previously known upper bound by an exponential factor. GRA

N75-28799# California Univ., Los Angeles. Dept. of Systems Sciences.
STOCHASTIC BILINEAR PARTIAL DIFFERENTIAL EQUATIONS Interim Report
A. V. Balakrishnan 1974 46 p refs
(Grant AF-AFOSR-2492-73; AF Proj. 9769)
(AD-A005725; AFOSR-75-0274TR) Avail: NTIS CSCL 12/1

The author proves existence and uniqueness theorems for a class of partial differential equations with a bilinear stochastic forcing term. The author gives both white noise and Wiener process (Ito integral) versions and indicates the interrelationships. Another feature is the use of semigroup theory, in contrast to the Lions-Magenes variational theory. GRA

N75-28800# Cornell Univ., Ithaca, N.Y. Dept. of Operations Research.
A (k PLUS 1)-DECISION SINGLE-STAGE SELECTION PROCEDURE FOR COMPARING k NORMAL MEANS WITH A FIXED KNOWN STANDARD: THE CASE OF COMMON KNOWN VARIANCE
Robert E. Bechhofer and Bruce W. Turnbull (Oxford. Univ. Engl.) Dec. 1974 35 p refs
(Contracts DAHC04-73-C-0008; N00014-67-A-0077-0020)
(AD-A004961; TR-242) Avail: NTIS CSCL 12/1

A (k-1)-decision single-stage selection procedure is proposed for the problem of comparing k normal means with a fixed known standard when the associated populations have a common known variance. None or one of the populations is to be selected, the procedure having the property that with probability at least $P^*(0)$ (specified), no population is to be selected when the largest population mean is sufficiently less than the standard, and with probability at least $P^*(1)$ (specified), the population with the largest population mean is to be selected when that mean is sufficiently greater than its closest competitor and the standard. Tables to implement the procedure are provided. Applications and generalizations are described. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N75-28801 British Library Lending Div., Boston Spa (England).
ON CALCULATING THE CHARACTERISTICS OF TIME SERIES BY THE METHOD OF STATISTICAL MODELLING
R. L. Kagan, V. K. Kandaskin, and E. I. Fedorcenko [1974] 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz, Observ. (USSR), v. 286, 1972 p 71-82
(BLL-M-23560-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The method of statistical modeling of time series for use in long range weather forecasting is discussed. Examples are given to illustrate the possibilities of the method. J.M.S.

N75-28802 Washington Univ., St. Louis, Mo.
STOCHASTIC OBSERVERS FOR NONLINEAR DYNAMIC SYSTEMS Ph.D. Thesis
Yona D. Raisis 1974 84 p
Avail: Univ. Microfilms Order No. 75-14934

An observer theory for stochastic nonlinear dynamic systems was obtained with the use of Liapunov type conditions. Liapunov type conditions as applied to stochastic systems are presented which were used to design an appropriate observer both for continuous and discrete systems. The observer obtained is a dynamic system driven by the observation of the state, and is designed so that the error between the system state and the observer output is exponentially bounded in mean square so that the observer state (output) can be used as a state estimate. The observer output (the estimated state) was used to design a feedback control that stabilizes an otherwise unstable system. Dissert. Abstr.

N75-28803 Pennsylvania State Univ., University Park.
A STOCHASTIC PROCESS DEFINED ON A MARKOV CHAIN: PROPERTIES AND AN APPLICATION TO METEOROLOGY Ph.D. Thesis
Richard Whitmore Katz 1974 120 p
Avail: Univ. Microfilms Order No. 75-15791

The Markov additive process and the extreme value process are considered. The asymptotic distribution and methods for computing the exact distribution of these two processes are derived. For the meteorological application, the stochastic process defined on a Markov chain consists of the sequence of amounts of precipitation occurring during consecutive time periods. The Markov chain has two states, a dry time period or a wet time period, and it is assumed that the distribution of the amount of precipitation during a given time period is determined by whether the previous time period is dry or wet. It is also assumed that the amounts of precipitation during consecutive wet time periods are independent. Dissert. Abstr.

N75-28804 North Carolina Univ., Chapel Hill.
STATISTICAL TESTS BASED ON THE LEVY AND PROHOROV METRICS Ph.D. Thesis
Charles Haynes Alexander, Jr. 1974 120 p
Avail: Univ. Microfilms Order No. 75-15602

Nonparametric one-sample and two-sample goodness-of-fit tests were developed, using as test statistics the Levy and Prohorov

distance between empirical distribution functions. Computational procedures are described for computing the test statistics. Recurrence equations are described for computing the distribution of the two-sample test statistics, using results about the maximal matchings in certain graphs. The asymptotic distribution of the one-sample test statistic was expressed in terms of the distribution of fluctuations in the sample path of the Brownian bridge stochastic process. Tables of these distributions are given in the appendix. The power of the tests against certain alternatives is discussed along with the results of simulations comparing the power with that of the Kolmogorov-Smirnov test. Dissert. Abstr.

N75-28805 North Carolina Univ., Chapel Hill.
DYNAMIC ECONOMETRIC MODELS: DYNAMIC SIMULATION FORECASTS AND TESTING FOR STABILITY Ph.D. Thesis
Elizabeth Feder Gustafson 1974 104 p
Avail: Univ. Microfilms Order No. 75-15644

Econometric models which contain lagged endogenous variables among the explanatory variables are called dynamic models, and are statistically and interpretationally different from static models. The major differences are briefly reviewed and two topics are considered in detail: the asymptotic distribution of dynamic simulation forecasts, and testing dynamic models for stability. The asymptotic distribution derived by Schmidt for dynamic simulation forecasts made outside of the original sample period is presented, and it is proved that this distribution is also valid for simulations performed within the original sample as long as the forecast period does not increase with sample size. A Monte Carlo study was conducted to investigate the power of stability tests, the small sample properties of coefficient estimators and estimators of the dominant root for stable and unstable models, and the relative small sample performances of stability tests based on three stage least squares estimation and on direct reduced form estimation. Models with dominant roots between .6 and 1.5 were examined. Dissert. Abstr.

N75-28806 University of Southern Calif., Los Angeles.
OPTIMAL LINEAR DISCRETE AND CONTINUOUS TIME ESTIMATION WITH UNCERTAIN SYSTEM MODEL PARAMETERS Ph.D. Thesis
Edward Joseph Knobbe 1975 112 p
Avail: Univ. Microfilms Order No. 75-15544

The optimal (minimum variance) recursive estimator is obtained for that class of estimation problems which can be formulated in state space using linear system models with uncertain system model parameters. The optimal recursive estimator is restricted to be a linear function (functional) of the observation, taken on the system state, and is obtained for both discrete and continuous time problem formulations. All statistical information, relative to the uncertain system model parameters, is imbedded in the linear structure of the estimator; this has the effect of increasing the dimensionality of the estimator. The estimation error covariance matrix, which is a useful measure of estimator performance, is obtained in recursive form for both the discrete and continuous time problem formulations.
Dissert. Abstr.

N75-28807 Virginia Polytechnic Inst. and State Univ., Blacksburg.
OPTIMAL PARAMETER ADAPTIVE ESTIMATION OF STOCHASTIC PROCESSES Ph.D. Thesis
Alper Kamil Caglayan 1974 136 p
Avail: Univ. Microfilms Order No. 75-15869

The simultaneous detection and least squares estimation of vector random processes is studied. A random process is observed with additive white Gaussian noise. The probability that a specific random process will be observed is specified for each one in the collection. The least squares estimate of the random process that is being observed is to be found in terms of the hypothesis conditioned estimates. It is shown that the best estimate is the linear combination of the hypothesis conditioned estimates weighted by the probabilities of the hypotheses conditioned on the observations, and an extended version of the partition theorem of parameter adaptive estimation is proved. A stochastic differential equation, is derived for the case of finitely many hypotheses along with an expression for the conditional error covariance in terms of the hypothesis conditioned error covariances. An application of the theory to the design of a digital flight control system is presented with real-time hybrid computer simulation results. Dissert. Abstr.

N75-28808 Houston Univ., Tex.
ASYMPTOTIC QUADRATIC MATRIX EQUATIONS AND STOCHASTIC STATE FILTERING Ph.D. Thesis
Charles DeHaven Osborn 1975 129 p
Avail: Univ. Microfilms Order No. 75-13945

The concept and use of the steady-state Kalman gain in Kalman filtering theory is presented. Use of the steady-state Kalman gain, in place of the real-time Kalman gain was shown to reduce both the error and the number of computations required in determining the optimal estimate of system states. The steady-state Kalman gain was computed directly from the system coefficient matrices using a recently derived algorithm. The method bypasses possible existence problems associated with the real-time Kalman gain matrix. Theoretical development, and examples are presented for both continuous and discrete systems. The results show conclusively the benefits gained by using the steady-state Kalman gain rather than the real-time Kalman gain.
Dissert. Abstr.

N75-28809# Ballistic Research Labs., Aberdeen Proving Ground, Md.
WASTING TIME MODELING, EH
F. E. Grubbs Jan. 1975 21 p ref
(DA Proj. 1T1-61102-A-148)
(AD-A005177; BRL-MR-2436) Avail: NTIS CSCL 12/2

The author records herein a discussion of the need for and uses of modeling in Army Research and Development work and to some extent generally in science and technology. The author brings to the forefront some continuing problems in the management of models with the hopes that rotated managers on one hand and modelers on the other might communicate better for the good of both. The aim in addition is to provide some preliminary material for appropriate, continuing discussion and especially for faster progress on the general subject. GRA

N75-28810# Union Coll., Schenectady, N.Y. Inst. of Administration and Management.
APPLICATIONS OF THE DISTRIBUTION OF THE PRODUCT Final Report, 1 Jan. - 30 Nov. 1974
Leo A. Aroian 1 Dec. 1974 9 p refs
(Contract N00014-72-A-0507-0001; NR Proj. 042-302)
(AD-A005121; AES-7417) Avail: NTIS CSCL 12/1

This paper treats applications of the product xy when x and y are distributed normally. It serves as an introduction to the author's book Tables and Percentage Points of the Distribution Function of a Product, 1959, Hughes Aircraft Co., Culver City, Calif. GRA

N75-28811# Army Concepts Analysis Agency, Bethesda, Md.
APPLICATION OF STATISTICAL TECHNIQUES TO MODEL SENSITIVITY TESTING Final Report
Jerry Thomas Sep. 1974 28 p refs
(AD-A005032; CAA-TP-74-10) Avail: NTIS CSCL 09/2

The advantages of factorial experimentation over the old classical One-Factor-At-A-Time experimentation for performing a sensitivity analysis on large scale computer models are discussed. An explanation is given of how time and effort can be saved in preparing inputs by choosing the proper sequence in which to make the model runs. Some ways in which the results can be analyzed and presented are also given. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N75-28812 Syracuse Univ., N.Y.
THE BAYESIAN ANALYSIS OF A NON-ADDITIVE MODEL Ph.D. Thesis
Mary Ann Hartz 1974 127 p
Avail: Univ. Microfilms Order No. 75-13989

A Bayesian analysis of a nonadditive model for the two-group case is presented. The population consisted of a score for each

subject. The subjects were divided, randomly, into two groups. Scores were observed for subjects in a control group while other scores were observed for subjects in an experimental group. A posterior distribution for four variables was derived using Bayes Theorem. Various joint, conditional, and marginal posterior distributions were obtained from this joint distribution. Means, variances, and the covariance were found. A posterior analysis is presented. Dissert. Abstr.

N75-28813 Wisconsin Univ., Madison.
EXPERIMENTS FOR ESTIMATING TRANSFORMATIONS IN THE RESPONSE Ph.D. Thesis
Ernest Elmo Gloyd 1974 103 p
Avail: Univ. Microfilms Order No. 75-9973

Experimental designs for estimating a transformation in the response for transformations are studied. While the main emphasis is placed on estimating the transformation parameter, the effects of designs on estimating model parameters were considered. The sampling theory approach uses the asymptotic variance of the maximum likelihood estimator of the transformation parameter. Rotational averages, given in Box and Draper, are used in second order linear models with two or more predictor variables when no prior information about the model parameters is available. This resulted in a general criteria for choosing a design when the designs under consideration are scaled to give equal design spreads. Several known designs are compared. Sampling theory sequential design procedures are given for linear models. Both Bayesian and sampling theory sequential design procedures are provided for nonlinear models. Examples are used to demonstrate the procedures and illustrate their results. Dissert. Abstr.

N75-28814 Yale Univ., New Haven, Conn.
ASYMPTOTIC EXPANSIONS FOR THE DISTRIBUTIONS OF THE LATENT ROOTS OF TWO MATRICES IN MULTIVARIATE ANALYSIS Ph.D. Thesis
Yasuko Chikuse 1974 104 p
Avail: Univ. Microfilms Order No. 75-15294

The main problem considered here is to derive asymptotic expansions (for large n, n1, and n2) for the joint and marginal distributions of the latent roots of each of the matrices S and S1S2 sup-1 under various assumptions concerning the latent roots of sigma and sigma 1 sigma 2 and sup-1. Asymptotic expansions for hypergeometric functions with two argument matrices, involved in exact expressions for the two joint density functions, are utilized in the derivation. The distributions of the extreme latent roots are also expanded using systems of partial differential equations satisfied by their distribution functions. The results obtained lend themselves to a Bayesian approach. Assuming a Wishart (conjugate) prior distribution of sigma sup-1, asymptotic expansions for large n are derived for the joint and marginal posterior distributions of the latent roots of sigma. Dissert. Abstr.

N75-28815 Marquette Univ., Milwaukee, Wis.
CONTROL OF LINEAR DISTRIBUTED PARAMETER SYSTEMS Ph.D. Thesis
Jean-Pierre Combot 1974 200 p
Avail: Univ. Microfilms Order No. 75-14983

A system described by an infinite dimensional ordinary differential equation is considered. Two models are developed according to the input and output structure. The input of the first model consists of a control vector function of time and space. The second model involves a finite number of spatially distributed input sources and output sensors. The last model's characteristics of sources and sensors are assumed to be given, but their locations remain parameters for the system. Analysis and synthesis problems are considered for both models (e.g., stability, controllability, observability, and optimal control). The optimal control theory is applied to solving problems such as minimum control energy, stabilization energy, and linear regulator. The pole placement problem is solved for the spatially distributed model. Specific optimal control problems are dealt with for the discrete-time spatially distributed model and the solution is obtained via a quadratic programming technique developed. Dissert. Abstr.

N75-28816 Washington Univ., St. Louis, Mo.
CONTROLLABILITY OF DISCRETE AND CONTINUOUS-TIME BILINEAR SYSTEMS Ph.D. Thesis
Gen-Sen James Cheng 1974 146 p
Avail: Univ. Microfilms Order No. 75-14916

The questions were investigated of controllability of bilinear systems, which are a class of control systems linear in the state with controls appearing multiplicatively. Criteria for global controllability with various admissible controls were obtained for both discrete and continuous-time bilinear systems, as the result of a study which unifies the discrete and continuous-time cases, as well as techniques from matrix analysis, Lie algebra, and differential geometry. Strong necessary conditions (close to sufficient) were obtained through Liapunov stability analysis, by requiring controllability with indefinitely small bounds. All the conditions are algebraic, and computational algorithms were obtained for their verification. Dissert. Abstr.

N75-28817 Washington Univ., St. Louis, Mo.
THE EQUIVALENCE OF NONLINEAR AND BILINEAR CONTROL SYSTEMS Ph.D. Thesis
Jackson Lee Sedwick, Jr. 1974 65 p
Avail: Univ. Microfilms Order No. 75-14936

Given a nonlinear control system, linear in the controls, all of whose terms have a common critical point, Lie algebraic conditions were established for the existence of a real analytic transformation to coordinates in which the system is bilinear (jointly linear in state and controls). The transformation was constructed locally by algebraic methods. The hypotheses used are analyticity, transitivity of the Lie algebra L associated with the bilinear system, and isomorphism of L to the Lie algebra of (nonlinear) vector fields associated with the original nonlinear system. Dissert. Abstr.

N75-28818 Michigan State Univ., East Lansing.
MULTIPROCESSING USING PROGRAM STRUCTURES Ph.D. Thesis
Edward Louis Lamie 1974 110 p
Avail: Univ. Microfilms Order No. 75-14776

A model which is capable of representing computations on a multiprocessing system was developed. The model takes the appearance of a directed graph where each node contains both a data vector and a mapping vector. The copy of a node concept was introduced and was used extensively. Various properties of the model were investigated including equivalence classes to input data and maximally parallel form. Solutions to the problems of repeatability, interference, and deadlock are presented. Properties of models which have restrictions placed on available resources were studied. Dissert. Abstr.

N75-28819 Kansas State Univ., Manhattan.
HYPOTHESIS TESTING IN NONLINEAR MODELS USING LINEAR ANALYSIS Ph.D. Thesis
Donald Kenji Yamashita 1974 79 p
Avail: Univ. Microfilms Order No. 75-14388

An analysis for testing the general linear hypothesis in a linear model was developed. The analysis is based on a newly defined linear model which uses the maximum likelihood estimates of the parameters as observations. It is shown that this analysis is equivalent to the usual analysis for testing the general linear hypothesis in a linear model. An analysis to test linear hypotheses in a nonlinear model was also studied. The analysis is motivated by the alternative technique for testing the general linear hypothesis in a linear model, and is also based on a newly defined linear model using the maximum likelihood estimates of the nonlinear parameters as observations. The asymptotic properties of maximum likelihood estimators were used to obtain the asymptotic distribution of the test statistic derived from this analysis. Dissert. Abstr.

N75-28820 Princeton Univ., N.J.
SOME PROPERTIES OF LINEARLY STATIONARY PROCESSES Ph.D. Thesis
Dag Biarne Tjoestheim 1974 81 p
Avail: Univ. Microfilms Order No. 75-6681

An extension of the class of wide sense stationary processes was studied by allowing the shift operators to be of a more general type. The most general case studied is that where the shift operators are assumed to be linear. A sufficient condition for a second order process to have linear shift operators is found,

and it is shown that a number of processes occurring in practice has linear shift operators. The subclass of processes is discussed where the shift operators are linear and uniformly bounded (the class of uniformly bounded linearly stationary (UBLS) processes). This class includes the class of wide sense stationary processes. The relationship between these two classes was explored, and it is found that every UBLS process can be obtained by a linear transformation of a wide sense stationary process. The relationship to the class of harmonizable processes and to the class of processes having normal shift operators was examined. Several explicit examples of UBLS processes are given and possible applications to time series modeling are indicated.
Dissert. Abstr.

N75-28821 Missouri Univ., Rolla.
CONSIDERATIONS IN THE DESIGN OF A NETWORK OF MINICOMPUTERS Ph.D. Thesis
Hardy Joseph Pottinger 1973 108 p
Avail: Univ. Microfilms Order No. 75-15846

The advantages of a network consisting of a number of minicomputers coupled to a large time shared computer are described. This type of network is very useful in the areas of data acquisition, real time control of experiments, and front-end processing for computer graphics. Problems associated with the development of a network of this type, various possible solutions, and the trade-offs involved are presented. These problems are classified into two categories: the interface between the network and the central computing facility, and the interface between the remote sites and the rest of the network. The design constraints, rationale, and implementation of the minicomputer network at the University of Missouri-Rolla are described.
Dissert. Abstr.

N75-28822*# Aerophysics Research Corp., Bellevue, Wash.
APPLICATION OF DIFFERENTIAL GAME THEORY TO ROLE-DETERMINATION IN AERIAL COMBAT
A. W. Merz Jul. 1975 57 p refs
(Contract NAS2-8844)
(NASA-CR-137713) Avail: NTIS HC $4.25 CSCL 12B

The development of criteria which specify the roles of pursuer and evader as functions of the relative geometry and of the important parameters of the problem are discussed. A reduced-order model of the relative motion is derived and discussed. In this model, the two aircraft move in the same plane at unequal but constant speeds, and with different maximum turn rates. The equations of relative motion are of third order, the dependent variables being the relative range, bearing, and heading of the two aircraft. Termination of the pursuit-evasion game is defined by either the heading-limited or the range-limited end condition. These are geometric conditions for which the evading aircraft is in front of the other, with the relative heading and relative range satisfying certain inequalities. Retrograde solutions to the equations of relative motion were used with the derived optimal terminal maneuvers to find where an assumed set of end conditions could have begun.
Author

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N75-28823 Michigan State Univ., East Lansing.
THE THEORY OF CLUSTER SETS Ph.D. Thesis
Ruth Ann Su 1974 164 p
Avail: Univ. Microfilms Order No. 75-14844

Properties are discussed pertaining to the set of limit points of a function at the boundary of its domain of definition. The functions studied may be divided into the following three major classes: arbitrary functions, normal functions and class A functions. Arbitrary functions have limited patterns of behavior with respect to cluster sets because of the particular topologies of the plane and sphere. A function is normal in a simply connected region if its family of arbitrary conformal mappings of the region onto itself has the property that every sequence of this family contains a subsequence which converges uniformly or tends uniformly to infinity on every compact subset of this region. Class A functions are also defined and discussed. Dissert. Abstr.

70 PHYSICS (GENERAL)

For geophysics see *46 Geophysics*. For astrophysics see *90 Astrophysics*. For solar physics see *92 Solar physics*.

N75-28824*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PROCEEDINGS: SYMPOSIUM ON CHARGE-COUPLED DEVICE TECHNOLOGY FOR SCIENTIFIC IMAGING APPLICATIONS
10 Jun. 1975 254 p refs Conf. held at Pasadena, Calif., 6-7 Mar. 1975
(Contract NAS7-100)
(NASA-CR-143231; JPL-SP-43-21) Avail: NTIS HC $8.50 CSCL 20F

Direct photon imaging and electron bombardment modes of charge coupled device imagers are considered in technical applications. For individual titles, see N75-28825 through N75-28844.

N75-28825* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN X-RAY SHADOWGRAPH TO LOCATE TRANSIENT HIGH-ENERGY CELESTIAL SOURCES c35
G. J. Fishman, T. A. Parnell, T. A. Rygg (Alabama Univ., Huntsville), and J. C. Gregory (Alabama Univ., Huntsville) *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 4-13 refs (For availability see N75-28824 19-70)
CSCL 03A

A new technique has been developed to locate strong, transient X-ray sources such as the recently discovered gamma ray bursts. The instrument, termed a shadowgraph, locates sources by detecting the X-ray shadow cast by a large occulting mask pattern on an imaging detector. Angular resolutions of from 2 to 10 arc minutes are obtainable while essentially full sky coverage is maintained. The optimum energy range of operation is between 20 keV and 100 keV. The high efficiency X-ray imaging detectors, which make it possible to locate bursts with intensities down to approximately 10 photons/sq cm sec, are capable of detecting single 20 keV photons with a spatial resolution of approximately 0.2 mm. The detectors consist of an X-ray to optical conversion phosphor, a multistage image intensifier, and a CCD image readout.
Author

N75-28826* Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
A CCD IMAGE TRANSDUCER AND PROCESSOR SUITABLE FOR SPACE FLIGHT c74
Donald J. Michels *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 14-29 refs (For availability see N75-28824 19-70)
CSCL 20F

A satellite borne extreme ultraviolet solar telescope makes use of CCD area arrays for both image readout and onboard data processing. The instrument is designed to view the inner solar corona in the wavelength band 170 - 630 A, and the output video stream may be selected by ground command to present the coronal scene, or the time-rate-of-change of the scene. Details of the CCD application to onboard image processing are described, and a discussion of the processor's potential for telemetry bandwidth compression is included. Optical coupling methods, data storage requirements, spatial and temporal resolution, and nonsymmetry of resolution (pitch) in the CCD are discussed.
Author

N75-28827* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCD STAR TRACKERS c74
W. C. Goss *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 31-45 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 03A

The application of CCDs to star trackers and star mappers is considered. Advantages and disadvantages of silicon CCD star trackers are compared with those of image dissector star trackers. It is concluded that the CCD has adequate sensitivity for most single star tracking tasks and is distinctly superior in

multiple star tracking or mapping applications. The signal and noise figures of several current CCD configurations are discussed. The basic structure of the required signal processing is described, and it is shown that resolution in excess of the number of CCD elements may be had by interpolation. Author

N75-28828* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCD IMAGING INSTRUMENTS FOR PLANETARY SPACECRAFT APPLICATIONS **c19**
Terrence H. Reilly and Mark Herring *In its* Proc.: Symp. on Charged-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 46-64 (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 14B

The development of new spacecraft camera systems to be used in conjunction with CCD sensors is reported. A brief overview of the science objectives and engineering constraints which inxluence the design of cameras for deep space is followed by a review of two current development programs, one leading to a line scan imager and the other to an area array frame camera. For each of these, a general description of the imager is given. It is evident that currently available CCDs fall short of requirements in some respects. Author

N75-28829* Massachusetts Inst. of Tech., Cambridge.
POTENTIAL USEFULNESS OF CCD IMAGERS IN ASTRONOMY **c74**
Thomas B. McCord and Jeffrey P. Bosel *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 65-69 refs (For availability see N75-28824 19-70)
CSCL 03A

Two dimensional detectors have been important in astronomy since the earliest days of the science. Recently, the requirements for greater photometric accuracy, sensitivity and spectral coverage have driven the search for better imaging devices. Electron beam readout devices with a variety of target materials and intensification schemes, including the SEC and silicon vidicons, have been used successfully. The CCD as an image detector has several potential advantages over electron beam readout devices; low noise, simple construction and geometric stability are among them. Author

N75-28830* American Science and Engineering, Inc., Cambridge, Mass.
PLANETARY INVESTIGATION UTILIZING AN IMAGING SPECTROMETER SYSTEM BASED UPON CHARGE INJECTION TECHNOLOGY **c91**
R. B. Wattson, P. Harvey, and R. Swift *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 70-79 refs (For availability see N75-28824 19-70)
CSCL 03B

An intrinsic silicon charge injection device (CID) television sensor array has been used in conjunction with a CaMoO4 colinear tunable acousto optic filter, a 61 inch reflector, a sophisticated computer system, and a digital color TV scan converter/computer to produce near IR images of Saturn and Jupiter with 10A spectral resolution and approximately 3 inch spatial resolution. The CID camera has successfully obtained digitized 100 x 100 array images with 5 minutes of exposure time, and slow-scanned readout to a computer. Details of the equipment setup, innovations, problems, experience, data and final equipment performance limits are given. Author

N75-28831* Maryland Univ., College Park.
ON A PHOTON-COUNTING ARRAY USING THE FAIRCHILD CCD-201 **c74**
D. G. Currie *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 80-90 refs (For availability see N75-28824 19-70)
CSCL 20F

The evaluation of certain performance parameters of the Fairchild CCD 201 and the proposed method of operation of an electron bombarded charge coupled device are described. Work in progress on the evaluation of the parameters relevant to remote, low noise operation is reported. These tests have been conducted using light input. The video data from the CCD are amplified, digitized, stored in a minicomputer memory, and then recorded on magnetic tape for analyzing. The device will be used in an array of sensors in the aperture plane of a telescope to discriminate between photoelectron events, and in the focal plane operating at single photoelectron sensitivity at a minimum of blooming and lag. Author

N75-28832* Princeton Univ. Observatory, N.J.
SOFT X-RAY DETECTION WITH THE FAIRCHILD 100 BY 100 CCD **c74**
George Renda and John L. Lowrance *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 91-105 refs (For availability see N75-28824 19-70)
CSCL 20F

The soft X-ray sensitivity of the Fairchild 100 x 100 element CCD is studied for possible use as a detector in plasma physics research. The experimental setup and laboratory results are reported including data on slow scan operation of the CCD and performance when cooled. Results from digital computer processing of the data to correct for element-to-element nonuniformities are also discussed. Author

N75-28833* General Electric Co., Schenectady, N.Y.
RECENT DEVELOPMENTS IN CID IMAGING **c74**
G. J. Michon, H. K. Burke, and D. M. Brown *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 106-115 refs Sponsored by ARPA and AFSC (For availability see N75-28824 19-70)
CSCL 20F

Readout of CID imaging arrays was first performed by injecting and detecting the signal charge from each sensing site in sequence. A new readout method, termed parallel injection, has been developed in which the functions of signal charge detection and injection have been separated. The level of signal charge at each sensing site is detected during a line scan, and during the line retrace interval, all charge in the selected line is injected. The parallel injection technique is well adapted to TV scan formats in that the signal is read out at high speed, line by line. A 244 line by 248 element TV compatible imager, employing this technique and including an on chip preamplifier, has been constructed and operation demonstrated. Author

N75-28834* Radio Corp. of America, Lancaster, Pa.
COOLED SLOW-SCAN PERFORMANCE OF A 512 BY 320 ELEMENT CHARGE-COUPLED IMAGER **c74**
R. L. Rodgers, III and D. L. Giovachino *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 116-124 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 20F

A 512 x 320 element charge coupled imager has been fabricated and tested under cooled slow scan conditions to evaluate the device's performance under a variety of long integration and slow scan readout conditions. Operation in a low blooming mode of operation enables the sensor to be exposed with portions of the image heavily overexposed, without those areas spreading into adjacent picture areas. Device design, layout, and operating mode are described, and presents experimental results, including displayed images taken under cooled slow scan operation, are reported. Author

N75-28835* Texas Instruments, Inc., Dallas.
LARGE-AREA CCD IMAGERS FOR SPACECRAFT APPLICATIONS **c74**
G. A. Antcliffe, L. J. Hornbeck, J. M. Younse, J. B. Barton, and D. R. Collins *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 125-136 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 20F

Backside illuminated CCD imagers with 100 x 160 resolution elements have been fabricated using double level metal technology. Detailed study of the optical performance of such arrays has been performed between 24 C and -40 C using data rates from 10 kHz to 1 MHz. A 400 x 400 array is presently being fabricated. Author

N75-28836* Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
A 190 BY 244 CHARGE-COUPLED AREA IMAGE SENSOR

WITH INTERLINE TRANSFER ORGANIZATION c74
L. R. Walsh *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 137-149 ref (For availability see N75-28824 19-70)
CSCL 20F

A 190 x 244 element charge coupled area image sensor has been designed, fabricated and tested. This sensor employs an interline transfer organization and buried n-channel technology. It features a novel on-chip charge integrator and a distributed floating gate amplifier for high and low light level applications. The X-Y element count has been chosen to establish the capability of producing an NTSC compatible video signal. The array size is also compatible with the Super 8 lens format. The first few sample devices have been successfully operated at full video bandwidth for both high and low light levels with the charge amplifier system. Author

N75-28837* Electronic Vision Corp., San Diego, Calif.
EXPERIMENTS ON THE USE OF CCD'S TO DETECT PHOTOELECTRON IMAGES c74
John P. Choisser *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 150-162 refs (For availability see N75-28824 19-70)
CSCL 20F

Image tube design and processing requirements for building an ICCD are discussed. Work is under way at EVC for building an ICCD using the Fairchild CCD 201 (100 x 100) array, and progress will be reported. Demountable tests have been made, exposing parts of a CCD 201 to 15 kilovolt electrons over five radiation levels from approximately 10 to 1 million rads. Other tubes built by EVC over the last few years which successfully use semiconductors to detect photoelectrons will be described briefly. Author

N75-28838* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A CCD FOR ULTRAVIOLET IMAGING USING A CCD PHOTOCATHODE COMBINATION c74
D. R. Collins (Texas Instruments, Inc., Dallas), C. G. Roberts (Texas Instruments, Inc., Dallas), W. W. Chan (Texas Instruments, Inc., Dallas), W. C. Rhines (Texas Instruments, Inc., Dallas), J. B. Barton (Texas Instruments, Inc., Dallas), and S. Sobieski *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 163-174 refs (For availability see N75-28824 19-70)
(Contract DAAK02-74-C-0359)
CSCL 20F

CCD in the electron-in mode, coupled with a bi-alkali photocathode to produce UV photon conversion, provides the following desirable features: (1) high UV response of the bi-alkali photocathode; (2) excellent imaging quality of a CCD area array; and (3) high signal-to-noise ratio due to the EBS (electron bombarded silicon) gain of the CCD operating in a tube configuration. This paper describes the rationale and progress made in developing a CCD for use as an UV imager. Author

N75-28839* Fairchild Space and Defense Systems, Syosset, N.Y.
SLOW-SCAN OPERATION OF LONG LINEAR CCD ARRAYS c74
Michael Vicars-Harris *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 175-185 refs (For availability see N75-28824 19-70)
CSCL 20F

Linear CCD arrays used singly or in optically butted assemblies permit practical implementation of long line array systems with 6000 or more picture elements per line with readout rates in excess of 5 MHz. Display and tape recording of slow scan imagery with over 1000 picture elements per line also presents unique challenges. This paper discusses performance results and the operation of 1728-element CCD arrays for generation of high resolution slow scan imagery and some approaches for recording and display of the imagery. The implication of dark current and its control are discussed. Author

N75-28840* Naval Research Lab., Washington, D.C.
IMAGING PERFORMANCE OF A CCD AREA ARRAY AT 200 K c74
W. D. Baker and D. J. Michels *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 186-191 (For availability see N75-28824 19-70)
CSCL 20F

The performance of a 100 x 100 charge coupled device imager was evaluated in the vicinity of 200 K. A set of operating conditions was determined which permits satisfactory operation of the imager from 300 K to 150 K while assuring maximum tolerance to ionizing radiation. Good imaging has been obtained for integration times in excess of 10 seconds at 200 K. Preliminary results on image storage indicate that storage times of many seconds are possible at 200 K. Author

N75-28841* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MTF AND POINT-SPREAD FUNCTION FOR A LARGE-AREA CCD IMAGER c74
K. J. Ando *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 192-215 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 20F

The MTF degradation due to lateral diffusion is calculated for a back illuminated CCD imager for typical device parameters. The discrete nature of the CCD and finite size of the photosensitive elements result in an additional MTF degradation. The Fourier transform approach is utilized to calculate the effective point spread function for these processes in the time domain. Experimental data are presented on the point spread function for a three phase, double level anodized aluminum 160 x 100 thinned and back illuminated CCD imager and compared with the theoretical results. A simple modification of the Crowell and Labuda model suggested by these results is presented. Author

N75-28842* Texas Instruments, Inc., Dallas.
EFFECTS OF IONIZING RADIATION ON CCD'S c76
G. A. Hartsell, D. A. Robinson, and D. R. Collins *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 216-227 refs (For availability see N75-28824 19-70)
(Contract F33615-74-C-1054)
CSCL 20L

The effects of 1.2 MeV gamma radiation and 20 MeV electrons on the operational characteristics of CCDs are studied. The effects of ionizing radiation on the charge transfer efficiency, dark current, and input/output circuitry are described. The improved radiation hardness of buried channel CCDs is compared to surface channel results. Both ion implanted and epitaxial layer buried channel device results are included. The advantages of using a single thickness SiO2 gate dielectric are described. The threshold voltage shifts and surface state density changes of dry, steam, and HCl doped oxides are discussed. Recent results on the recovery times and total dose effects of high dose rate pulses of 20 MeV electrons are reported. Author

N75-28843* Naval Research Lab., Washington, D.C.
EFFECTS OF IONIZING RADIATION ON CHARGE-COUPLED IMAGERS c76
J. M. Killiany, W. D. Baker, N. S. Saks, and D. F. Barbe *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 228-242 refs (For availability see N75-28824 19-70)
CSCL 20L

The effects of ionizing radiation on three different charge coupled imagers have been investigated. Device performance was evaluated as a function of total gamma ray dose. The principal failure mechanisms have been identified for each particular device structure. The clock and bias voltages required for high total dose operation of the devices are presented. Author

N75-28844* RCA Labs., Princeton, N.J.
EFFECTS OF RADIATION ON CHARGE-COUPLED DEVICES c76
James E. Carnes, A. Danforth Cope, Leonard R. Rockett, and Kenneth M. Schlesier *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 243-251 refs (For availability see N75-28824 19-70)
(Contract F19628-74-C-0039)
CSCL 20L

The effects of 1 MeV electron irradiation upon the performance of two phase, polysilicon aluminum gate CCDs are reported. Both n- and p-surface channel and n-buried channel devices are investigated using 64- and 128-stage line arrays. Characteristics measured as a function of radiation dose include: Transfer inefficiency, threshold voltage, field effect mobility, interface state density, full well signal level and dark current. Surface channel devices are found to degrade considerably at less than 10 to the 5th power rads (Si) due to the large increase in fast interface state density caused by radiation. Buried channel devices maintain efficient operation to the highest dose levels used.
Author

N75-28845# Florida Technological Univ., Orlando.
A STUDY OF THE MICROWAVE REFLECTIVE PROPERTIES OF AEROSOLS Final Report
Paul E. Speh, Jr. and Ernest E. Erickson Jan. 1975 45 p refs
(Contract F30602-72-C-0448)
(AD-A005679; RADC-TR-74-337) Avail: NTIS CSCL 20/14

The report deals with the reflective properties of selected aerosols subjected to microwave radiation. The backscatter cross section of a sphere is developed analytically as a basis for experimental verification. The most pertinent material parameters necessary for maximum reflectivity are discussed and are used to justify the aerosols selected for the experiment. The experimental procedures and the equipment calibration techniques are prefaced by a discussion of the design and the construction of the aerosol chamber and the microwave source apparatus. The experimental results and the calculated backscatter cross section of the aerosols listed are examined. Conclusions are discussed and applications of the results are offered for consideration.
GRA

N75-28846# California Univ., Berkeley. Electronics Research Lab.
SCATTERING BY BURIED OBSTACLES Final Report, 20 Apr. 1971 - 31 Jul. 1974
K. K. Mei, W. C. Kuo, and S. K. Chang Nov. 1974 120 p refs
(Contract DAAK02-71-C-0206)
(AD-A005237) Avail: NTIS CSCL 17/6

The purpose of this investigation is to find theoretical solutions to scattering of electromagnetic fields by buried obstacles. The first part of the investigation is primarily concerned with the source problem of the scattering phenomena. It enables us to find the near fields of an antenna above a lossy ground and the near fields penetration into the ground, which are the primary fields to be scattered by the obstacles. In order to study that problem the Sommerfeld's integrals are extensively studied. The second part of the investigation involves some practical application of the results of the first part which have direct bearing on the detectability of buried obstacles. The third part of the investigation contains the preliminary work of scattering by buried dielectric obstacles. Since the final objective of this research is the detection of buried dielectric bodies, the technique of computing dielectric scattering is of primary importance. The application of the Uni-moment method to 2-dimensional scattering problems is presented.
GRA

N75-28847# Boeing Aerospace Co., Seattle, Wash.
EMPIRICALLY DERIVED TRANSFER FUNCTIONS THREAT ENVIRONMENT TO INTERNAL ENVIRONMENT (S-ZONE) MSPP Final Report
4 Dec. 1974 28 p refs
(Contract DACA87-72-C-0002)
(AD-A005623; TM-88) Avail: NTIS CSCL 15/3

Magnetic-field transfer functions for outside-to-inside test positions are presented. The transfer functions were determined from the MSPP Site Test 7 test data. In addition, comparison is made between transfer functions derived from test data and calculated transfer functions.
GRA

7.1 ACOUSTICS

Includes sound generation, transmission and attenuation.

For noise pollution see *45 Environment Pollution*.

N75-28848 Georgetown Univ., Washington, D.C.
PROPAGATION CHARACTERISTICS OF ULTRASONIC SURFACE WAVES ON ANISOTROPIC COPPER Ph.D. Thesis
Mohamad Behravesh 1974 106 p
Avail: Univ. Microfilms Order No. 75-14870

Schlieren method was used to investigate propagation characteristics of acoustic surface waves generated by a bounded ultrasonic beam incident at water-single crystal copper interface. Reradiation effects of surface waves, as observed in the reflected ultrasonic beam, are related to changes in the particle displacement ellipse describing the surface wave. A parameter beta is introduced which is characteristic of the component of the ellipse perpendicular to the crystal surface. Calculated values of beta were used to relate observable reflected beam effects to the orientation-dependent properties of surface waves for the (100) and (111) planes of copper. The Schlieren method is modified to show experimentally that the direction of energy-flow for surface waves propagating along an arbitrary direction on anisotropic copper is noncollinear with the propagation direction of the surface waves. Experimental results are compared with theoretically calculated values of the angle between wave propagation direction and energy-flow direction for surface waves on the (100), (110), and (111) planes of copper. Dissert. Abstr.

N75-28849*# Boeing Co., Wichita, Kans.
ACOUSTIC RADIATION FROM LINED, UNFLANGED DUCTS: ACOUSTIC SOURCE DISTRIBUTION PROGRAM
R. J. Beckemeyer and D. T. Sawdy 12 Dec. 1971 202 p refs
(Contract NAS3-14321)
(NASA-CR-120849; D3-8611-1) Avail: NTIS HC $7.25 CSCL 20A

An acoustic radiation analysis was developed to predict the far-field characteristics of fan noise radiated from an acoustically lined unflanged duct. This analysis is comprised of three modular digital computer programs which together provide a capability of accounting for the impedance mismatch at the duct exit plane. Admissible duct configurations include circular or annular, with or without an extended centerbody. This variation in duct configurations provides a capability of modeling inlet and fan duct noise radiation. The computer programs are described in detail.
Author

N75-28850*# Boeing Co., Wichita, Kans.
ACOUSTIC RADIATION FROM LINED UNFLANGED DUCTS: DIRECTIVITY INDEX PROGRAM
R. J. Beckemeyer and D. T. Sawdy 12 Dec. 1971 67 p refs
(Contract NAS3-14321)
(NASA-CR-120850; D3-8611-2) Avail: NTIS HC $4.25 CSCL 20A

For abstract, see N75-28849.

N75-28851*# Boeing Co., Wichita, Kans.
ACOUSTIC RADIATION FROM LINED, UNFLANGED DUCTS: DUCT TERMINATION IMPEDANCE PROGRAM
R. J. Beckemeyer and D. T. Sawdy 12 Dec. 1971 77 p refs
(Contract NAS3-14321)
(NASA-CR-120851; D3-8611-3) Avail: NTIS HC $4.75 CSCL 20A

For abstract, see N75-28849.

N75-28852# Naval Undersea Center, San Diego, Calif.
INTERACTIVE SONAR TARGET CLASSIFICATION DISPLAY SYSTEM USING NONLINEAR FEATURE SELECTION TECHNIQUES Research Report, Jul. 1972 - Jun. 1974
John A. Roese Nov. 1974 54 p refs
(AD-A005362; NUC-TP-437) Avail: NTIS CSCL 17/1

A prototype man-machine interactive display system for target classification has been designed and implemented. This system features a high degree of interaction between the display operator

and the computer in the processing and display of multi-dimensional target classification data. The functions of the system are to demonstrate the feasibility of direct operator interaction with the processing of a data base and to aid in the development and evaluation of target classification strategies. The interactive target-classification system is unique for both its use of nonlinear feature-selection transformations to reduce the dimensionality of the measurement space data and its use of steroscopic techniques for direct viewing of the resulting three-dimensional target-classification feature space. Thus, the interactive target-classification system introduces some new alternatives to traditional sonar data processing and display techniques. GRA

N75-28853# Naval Coastal Systems Lab., Panama City, Fla.
ULTRASONIC LENS DEVELOPMENT
D. L. Folds Sep. 1974 28 p
(AD-A005489; NCSL-219-74) Avail: NTIS CSCL 20/1

The solid ultrasonic lens has received some attention as a high resolution sonar beam former in the past but until recently no detailed investigation has been undertaken. Investigations currently underway have shown that many of the techniques of optical lens design are directly applicable to ultrasonics. These techniques have been applied to design a number of lenses which should prove useful in sonar applications where large numbers of multiple beams in one or two dimensions are required. In this report, the design and performance characteristics of solid lenses are discussed, with experimental data demonstrating the performance of singlets, doublets, and a highly corrected four-element lens shown to be capable of forming 0.2-degree beams over a 20-degree field of view. Data of particular interest to the sonar designer such as insertion losses, sensor size, and image surface shape are discussed. GRA

N75-28854# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
OPTIMAL ESTIMATION OF SOURCE LOCATION AND SPECTRUM IN THE NEAR FIELD Technical Report, 1973 - 1974
Donald A. Murphy, Anthony J. Rockmore, and Neil J. Bershad 1 Nov. 1974 75 p
(Contract N00014-69-C-0034; NR Proj. 185-600)
(AD-A005521; FR-74-11-755) Avail: NTIS CSCL 20/1

Optimal estimation and detection techniques are used to determine the properties of a radiating source with the use of a receiving line array in the near field. The maximum likelihood estimates of the location of a point source and its power spectral density are derived for a general noise covariance matrix. The specific case of noise plus a point source interference is examined. The estimator structure is shown to consist of an estimator beam for the interference which is optimally subtracted from the estimator beam for the signal with subsequent bias removal for the noise. The performance is calculated and compared with previously calculated noise fields such as uncorrelated noise and a model of isotropic noise. The problem of discrimination of two point sources in the presence of a third interfering point source is solved using a likelihood ratio test. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure and molecular spectra.

N75-28855 Louisiana State Univ. and A&M Coll., Baton Rouge.
PATH-INTEGRAL EVALUATION OF THE TIME-EVOLUTION PROPAGATOR FOR QUADRATIC HAMILTONIAN SYSTEMS WITH APPLICATION TO THE LEE MODEL Ph.D. Thesis
John Lee Pell 1974 72 p
Avail: Univ. Microfilms Order No. 75-14275

Path integral methods are used to derive an exact expression for the time evolution propagator for a broad class of systems with quadratic Hamiltonians. For a certain sub-class of such systems, the result is reduced to a simplified closed form. The propagators are exhibited for several illustrative elementary cases and for the Lee model for a single heavy particle, with two isotopic states of equal mass, interacting with a bosonic field. The propagator for the latter is used to calculate the survival probability of the unstable state of the heavy particle with no bosons present. GRA

N75-28856 Illinois Univ., Urbana.
RAMAN AND NMR STUDIES OF THE EFFECTS OF DENSITY AND TEMPERATURE ON THE MOLECULAR DYNAMICS IN FLUIDS Ph.D. Thesis
John Hyde Campbell 1975 169 p
Avail: Univ. Microfilms Order No. 75-14089

The effects of density and temperature were studied in detail using high pressure Raman and NMR spectroscopy. The molecular fluids studied include three symmetric tops, methyl iodide, benzene, and chloroform, and one spherical top, carbon tetrafluoride. From the measured vibrational-rotational Raman bandshapes, the reorientation correlation function is evaluated. These data show the result that small changes in density produce the major influence on the molecular reorientation in liquids. From NMR spin-lattice relaxation times in carbon tetrafluoride, the angular momentum correlation time was determined. The recent rough hard sphere model by Chandler was used to interpret these results, and it is shown that one can accurately predict the density dependence of both the angular and linear momentum correlation times for densities greater than twice the critical point. The vibrational relaxation time was determined from band broadening of the isotropic component of the vibrational Raman bandshape. Dissert. Abstr.

N75-28857 Texas A&M Univ., College Station.
MODEL REFERENCE ADAPTIVE CONTROL SPECIFICATION FOR A STEAM HEATED FINNED TUBE HEAT EXCHANGER Ph.D. Thesis
Joseph Michael Davidson 1974 315 p
Avail: Univ. Microfilms Order No. 75-15021

Model reference adaptive control was used to improve the dynamic performance as the system undergoes changes in its describing transfer function. Outlet coolant temperature was regulated by steam flow in a direct digital control feedback loop, and process identification was carried out in closed loop. A prespecified dynamical behavior was imposed upon the system by adjustment of the control algorithm parameters. The process output is subsequently forced to track a model unit step set point response. Simulation studies were conducted with a realistic nonlinear mathematical model for the heat exchanger system. The nonlinear process is modeled by a second-order transfer function with deadtime (linear model). Process identification based upon quasilinearization, maximum likelihood, generalized least squares, and Kalman's pulse transfer function method was achieved to obtain linear discrete process models at three different operating conditions in each of three conventional feedback control modes. Dissert. Abstr.

N75-28858*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
VIBRATION-TRANSLATION ENERGY TRANSFER IN ANHARMONIC DIATOMIC MOLECULES. 2: THE VIBRATIONAL QUANTUM NUMBER DEPENDENCE
Robert L. McKenzie Jun. 1975 45 p refs
(NASA-TM-X-62453; A-6152-Vol-2) Avail: NTIS HC $3.75 CSCL 20H

A semiclassical model of the inelastic collision between a vibrationally excited anharmonic oscillator and a structureless atom was used to predict the variation of thermally averaged vibration-translation rate coefficients with temperature and initial-state quantum number. Multiple oscillator states were included in a numerical solution for collinear encounters. The results are compared with CO-He experimental values for both ground and excited initial states using several simplified forms of the interaction potential. The numerical model was also used as a basis for evaluating several less complete but analytic models. Two computationally simple analytic approximations were found that successfully reproduced the numerical rate coefficients for a wide range of molecular properties and collision partners. Their limitations were also identified. The relative rates of multiple-quantum transitions from excited states were evaluated for several molecular types. Author

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation*.

N75-28859+ Montpellier Univ. (France). Dept. de Physique Mathematique.
THE INVERSE PROBLEM FOR THE ONE-DIMENSIONAL SCHROEDINGER EQUATION WITH AN ENERGY-DEPENDENT POTENTIAL, PART 1
Marcel Jaulent and C. Jean Jan. 1975 31 p refs
(PM/75/1-Pt-1) Avail: NTIS HC $3.75

The Schroedinger equation is considered. The energy dependence of the potential takes a certain form and belongs to a large class V of pairs of real potentials admitting no bound state. To each pair of V is associated a 2x2 matrix valued function shown to be the scattering matrix. Its real part is identified with the physical part of the scattering problem while the complex part of the scattering matrix is identified with the reflection coefficient to the right. Both real and complex parts are shown to belong to classes S and R the properties of which are given. Two systems of integrodifferential equations are derived connecting quantities related to the real and complex part of the scattering matrix. ESRO

N75-28860+ Montpellier Univ. (France). Dept. de Physique Mathematique.
THE INVERSE PROBLEM FOR THE ONE-DIMENSIONAL SCHROEDINGER EQUATION WITH AN ENERGY-DEPENDENT POTENTIAL, PART 2
Marcel Jaulent and C. Jean Jan. 1975 43 p refs
(PM/75/2-Pt-2) Avail: NTIS HC $3.75

Two systems of differential and integral equations introduced in a previous paper are solved in relation to the one dimensional Schroedinger equation with energy dependent potential. Investigating the inverse reflection problem, it is shown that a necessary and sufficient condition for a given function to be the reflection coefficient to the right, associated with a pair of real potentials admitting no bound state and belonging to a class V (that is defined), is that this function belongs to a specific class R of functions the properties of which are given. The study is applied to the solution of an inverse problem for the one dimensional Klein-Gordon equation of zero mass with static potential. ESRO

N75-28861+ Montpellier Univ. (France). Dept. of Physique Mathematique.
ON THE INVERSE PROBLEM FOR THE RADIAL SCHROEDINGER EQUATION WITH AN ENERGY-DEPENDENT POTENTIAL
Marcel Jaulent Mar. 1975 7 p refs In FRENCH; ENGLISH summary
(PM/75/6) Avail: NTIS HC $3.25

Some improvements are presented on the inverse problem for the radial s-wave Schroedinger equation. Sufficient conditions I1, I2, I2' and I3 were given for a function to be the scattering matrix associated with a pair belonging to a large class of real potential pairs admitting no bound state. ESRO

N75-28862# Comptroller General of the United States, Washington, D.C.
THE LIQUID METAL FAST BREEDER REACTOR: PROMISES AND UNCERTAINTIES
[1975] 155 p refs
(OSP-76-1) Avail: NTIS HC $6.25

The Federal Government's role in the development of the liquid metal fast breeder reactor for use in electrical power generating plants is investigated. The managerial and technical aspects of the LMFBR program are considered along with its economic, environmental, and social implications. Conclusions and recommendations are given. Author

N75-28863# Harry Diamond Labs., Washington, D.C.
SOME CHARACTERISTICS OF THE GAMBLE 1 ELECTRON BEAM
Dale R. Schallhorn, Robert B. Oswald, Jr., Gary L. Skillington, and Timothy R. Oldham Dec. 1974 21 p Sponsored by DNA
(AD-A005616; HDL-TR-1677) Avail: NTIS

A series of experiments was performed to develop the procedures and techniques that are required to operate the Gamble I facility so that reproducible, fairly uniform electron beams could be obtained. With one guide cone, two entrance apertures for the guide cone, and five different charging conditions, six fluence levels were established (20, 40, 60, 100, 160 and 200 cal/cm squared). GRA

N75-28864# Army Electronics Command, Fort Monmouth, N.J.
THE UTILIZATION OF STARUTE DECELERATORS FOR IMPROVED UPPER ATMOSPHERE MEASUREMENTS
R. O. Olsen and B. W. Kennedy Dec. 1974 23 p refs
(DA Proj. 1T7-65702-D-127)
(AD-A005589; ECOM-5551) Avail: NTIS CSCL 19/7

The results of flight tests of a 4.5-m-square Arcas Starute developed for upper atmosphere research are described. The development of this Starute evolved from the 2-m-square Loki Starute, a decelerator currently being used operationally for the Meteorological Rocket Network (MRN). The Arcas Starute possesses the following characteristics: Low ballistic coefficient; deployment reliability at high altitudes; high stability; low angle of attack; and high radar reflectivity. The Arcas Starute was deployed with different payload weights over a range of altitudes from 61 km to 78 km. In all cases the decelerator remained subsonic and proved to be extremely stable. The paper discusses the environmental conditions under which decelerators are deployed from a research rocket, and the manner in which they are expected to perform when the deployment altitude varies from 61 km to 100 km. GRA

N75-28865# Energy Sciences, Inc., Burlington, Mass.
EVALUATION OF BEAM DIAGNOSTIC TECHNIQUES Final Report, Apr. 1973
John R. Uglum and John J. Moriarty 25 Nov. 1974 51 p refs
(Contract DNA001-72-C-0175; DNA Proj. NWED-LA121)
(AD-A004969; DNA-3490F) Avail: NTIS CSCL 20/7

Two new diagnostic techniques were considered for use with intense electron beams. They were Compton scattering and Cerenkov radiation. Only the latter was evaluated on the Gamble I facility; at a fluence level of about 100 cal/cm squared it was found that a 0.004 inch thick fused silica radiator gave an optical signal which was directly proportional to the beam current. It also appears that a thinner radiator could be used to time resolve the beam energy, current, and average angle of incidence. GRA

74 OPTICS

Includes light phenomena.

N75-28866 Louisiana State Univ. and A&M Coll., Baton Rouge.
INVESTIGATION OF A METHOD TO DETERMINE THE EFFECTS OF VARIABLES ON REFLECTANCE AND EMITTANCE DATA FROM NATURAL SURFACES UNDER NATURAL CONDITIONS Ph.D. Thesis
John Franklin Hagewood 1974 380 p
Avail: Univ. Microfilms Order No. 75-14252

Bidirectional reflectance data from natural surfaces was obtained by using an optically folding mirror to transfer the reflected energy from the test surface to a spectroradiometer. The folding mirror was a surface reflector made by stretching Mylar vacuum coated with aluminum over a light-weight frame. The folding mirror was positioned over the test surfaces with a moveable platform for both laboratory and field tests. Field tests were also conducted using a tethered balloon system to position the folding mirror. A spectroradiometer capable of detecting energies in small bandwidths throughout the electromagnetic spectrum from 0.3 microns to 3.0 microns was designed and built. Bidirectional reflectance data and variations in the data with source angles were obtained from Saint Augustine grass, Bermuda grass, and a black alluvium soil from the Mississippi River delta. Dissert. Abstr.

N75-28867 Illinois Univ., Urbana.
EXCITATION OF AN OPTICAL FIBER BY A GAUSSIAN BEAM Ph.D. Thesis
Masoud Mostafavi 1975 80 p
Avail: Univ. Microfilms Order No. 75-14148

The problem of excitation of an optical fiber at normal incidence by a Gaussian beam is investigated. The first step involves the derivation of the eigenvalues and eigenfunctions of the guided modes as well as the radiation field of the fiber. Then, the eigenvalue equation is solved for the frequencies of interest using numerical techniques. Gaussian beams with different spot sizes are considered as the incident field. The second step entails the application of the continuity conditions at the interface. Dissert. Abstr.

N75-28868+ Societe Coderg, Clichy (France). Dept. Interferometrie.
OPTIMIZATION OF A MICHELSON INTERFEROMETER WITH ASSOCIATED REAL TIME COMPUTER FOR THE MEDIUM AND FAR INFRARED Final Report [OPTIMISATION D'UN INTERFEROMETRE DE MICHELSON COUPLE A UN CALCULATEUR EN TEMPS REEL DESTINE A L'INFRA ROUGE DE 1000 A 0.1 CM. ETUDE ET MISE AU POINT D'UN INTERFEROMETRE TRAVAILLANT DANS L'INFRA ROUGE MOYEN ET LIE A UN CALCULATEUR A PROGRAMME CABLE]
[1974] 39 p In FRENCH
(Contract DGRST-72-7-0420)
Avail: NTIS HC $3.75

Two different interferometers of high resolution equipped for real time operations are described. The various components of the instruments are described with regard to various separating plates and associated filters, a focal system with eyecat mirrors, and the sample compartment. The automated electronic systems are discussed with regard to sampling system, entrainment, separatrix and filter changes, data acquisition, and phase correction. Data processing is performed by an on-line computer using Fourier transform and where the sine table is contained in a ROM. ESRO

N75-28869# Technische Universitaet, Munich (West Germany).
RESEARCH ON STEREOPTICAL AND MONOCULAR MEASUREMENTS OF IMAGE POINTS Ph.D. Thesis [UNTERSUCHUNGEN UEBER STEREOSKOPISCHE UND MONOKULARE MESSUNGEN AN BILDPUNKTEN]
Norbert Winkler 28 Feb. 1974 81 p refs In GERMAN
Avail: NTIS HC $4.75

Mono versus stereo analytical photogrammetry on image transformation points uses correlation of median rest parallaxes of the models, studies on transforming points, and strip equalization methods to grade measuring methods according to decreasing quality as: stero, stereo Dove, and mono mono.
Transl. by G.G.

N75-28870# Instituto de Investigaciones Cientificas y Tecnicas de las Fuerzas Armadas (CITEFA), Buenos Aires (Argentina).
FUNDAMENTALS OF DIFFERENTIAL SHEARING INTERFEROMETRY
Jorge E. Toni, Raul JimenezRebagliati, German DaCosta, and Jose M. Astigueta May 1975 39 p refs In SPANISH; ENGLISH summary
(Rept-181) Avail: NTIS HC $3.75

Classical two beam interferometers are described and the different types of shearing interferometers are discussed. The principal component of these interferometers is the interferometric unit and consequently, the different effects of plane glass plate, wedge, diffraction grating, Savart plate and Wollaston prism were considered. The theory of finite and infinite fringe formation is included, and some experimental results and the application of these techniques are also given. Author

N75-28871*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, Tex.
OPTICAL NOISE SUPPRESSION DEVICE AND METHOD Patent Application
Joseph L. Horner, inventor (to NASA) (DOT) Filed 30 Jun. 1975 19 p Sponsored by NASA
(NASA-Case-MSC-12640-1; US-Patent-Appl-SN-591568) Avail: NTIS HC $3.25 CSCL 20F

Disclosed is a device and method for suppression of optical noise in an optical spatial filtering system using highly coherent light. In the disclosed embodiment, input photographic film to be processed in the system, and output photographic film to be exposed, are each mounted on lateral translation devices. During application of the coherent light for exposure of the output film, the two translation devices are moved in synchronism by a motor-driven gear and linkage assembly. The ratio of the resulting output film translation to the input film translation is equal to the magnification of the optical data processing system. The noise pattern associated with the lenses and other elements in the optical processing system remains stationary while the image producing light moves laterally through the pattern with the output film, thus averaging out the noise effect at the output film.
Dissert. Abstr.

N75-28872# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
POLISHING METHODS FOR KCl Interim Report
William S. Ewing 8 Mar. 1974 13 p
(AD-A005389; AFCRL-TR-74-0134; AFCRL-IP-216) Avail: NTIS CSCL 20/6

Polishing techniques used by AFCRL for polishing alkali halides are described. A brief rationale is given for the techniques and materials required for low damage window polishing. Step-by-step procedures are outlined for use by technician or higher level individuals interested in window polishing. Particular attention is given to methods of rough cutting mechanical polishing and chemical polishing of KCl crystals. GRA

N75-28873# Little (Arthur D.), Inc., Cambridge, Mass.
GROWTH AND CHARACTERIZATION OF OPTICAL WAVEGUIDES FOR 10.6 MICROMETER LIGHT Annual Technical Report, 1 Feb. 1973 - 30 Jun. 1974
John S. Haggerty and William L. Robbins 30 Jan. 1975 30 p refs
(Contract N00014-73-C-0263; ARPA Order 2327)
(AD-A005635; ADL-C-75519) Avail: NTIS CSCL 20/6

The growth and subsequent optical characterization of single crystal Ge fibers for transmission at 10.6 micrometers is described. Single crystal Ge fibers 0.007 to 0.020 inch in diameter were grown by a laser-heated floating zone technique. The technique was shown to be effective for producing optical quality fibers with absorption coefficients as low as 0.06/cm, or 0.26 db/cm at 10.6 micrometers. GRA

N75-28874# White Sands Missile Range, N.Mex. Instrumentation Directorate.
A NEW TARGET TRACKING ALGORITHM FOR THE AUTOMATIC PROGRAMMABLE FILM READER Final Report
A. L. Gilbert and G. M. Flachs Oct. 1974 26 p
(DA Proj. 1U7-65711-DE-93)
(AD-A005201; STEWS-ID-74-3) Avail: NTIS CSCL 17/8

White Sands Missile Range (WSMR) has a requirement to accurately determine the position and pitch attitude (V-angle) of missiles with respect to fiducials in a frame of visual information. This requirement is to effect the boresight correction, i.e., the correction in angle to the mount encoder information for elevation and azimuth where the camera and associated optics are accurately positioned relative to the encoders. Since manual film reading is both relatively slow and quite tedious, a method for automatic film reading that is at least as accurate and as fast as manual reading would be a significant development for WSMR. During the past several years, a great deal of effort has been expended by WSMR to develop such a film reader, the end result being the development of the Automatic Programmable Film Reader. GRA

N75-28875# Kaiser Aerospace and Electronics Corp., Palo Alto, Calif.
FEASIBILITY STUDY FOR A DUAL FIELD OF VIEW-SINGLE DETECTOR ARRAY INFRARED SYSTEM Final Report
Jun. 1974 89 p
(Contract DAAK02-72-C-0419)
(AD-A005658) Avail: NTIS CSCL 17/5

An analytical study was conducted to determine the feasibility

of multiplexing two infrared images, gathered by two separate lens systems, at a coincident focal plane thereby permitting utilization of only one infrared detector array for time shared processing of both images. The study was primarily directed towards determining the feasibility and practicality of, dual image opto-mechanical scanning techniques, and retaining flicker-free video presentations by storing and processing the multiplexed IR video. The results of the study show that the concept is feasible and that hardware can be implemented by using state-of-the-art techniques. The investigation into scanning techniques and data storage media indicates that the most suitable hardware implementation would consist of a Collimated Dual Galvanometer Optical Scanner and a Storage Refresh Memory using MOS Shift Registers. GRA

N75-28876# General Research Corp., McLean, Va.
ADVANCED ELECTRO-OPTICAL SYSTEM HARDENING. PHASE 2: COMPUTER AIDED SUSCEPTIBILITY ANALYSIS OF THE HOST SENSOR AMPLIFIER TO IEMP Final Report
John L. Gilbert Dec. 1974 38 p refs
(Contract DAAG39-73-C-0047; DA Proj. 1W3-62306-AH-72; HDL Proj. 358433)
(AD-A005084; Rept-531W-01-CR; HDL-CR-047-2) Avail: NTIS CSCL 17/5

The study examines the vulnerability of one channel of the HOST detector amplifier to internal electromagnetic pulse (IEMP) induced transients coupling into the circuit at certain selected locations. Only the effects of the induced transients on the circuit, including transient-radiation effects on electronics (TREE) effects, are studied, not the IEMP coupling modes. The entry points for the transients are assumed to be cables interconnecting the various subcircuits composing the amplifier. The circuit operation was simulated using the NET-2 network analysis computer program. In the simulation, models were used which incorporated both linear and nonlinear operating characteristics. The induced transients were simulated using current pulses 1 sq microsec. HDL experimental component failure data for 1-microsec pulses were used for circuit component failure criteria. GRA

N75-28877# Madrid Univ. (Spain).
OPTICAL CONSTANTS OF SiO IN THE IR REGION Final Technical Report, 1 Jan. - 31 Dec. 1973
D. Escolar and J. Morcillo Jul. 1974 119 p refs
(Contract DAJA37-73-C-0468; DA Proj. 2O0-61102-B-11)
(AD-A005086; FTR-1) Avail: NTIS CSCL 20/6

Values of the optical constants of vacuum deposited thin films of silicon monoxide over the range 1.0 to 50.0 microns, obtained from Attenuated Total Reflectance (ATR) are computed with a simple rigorous method. The ATR element used is a commercial one. An analysis is also presented of the calculation of n and k from transmission measurements showing consistency with ATR measurements for a liquid sample. A double beam ATR system is described for making precise measurement at a variable angle of incidence of the reflectivity using only one hemicylindrical reflectance element. The cell has two compartments for sample and reference beam respectively. The beam has a wedge shape with the focal line parallel to the cylinder axis and the optical elements are all standard mirrors.
Author (GRA)

N75-28878# Itek Corp., Lexington, Mass. Optical Systems Div.
CHARACTERIZATION AND OPTIMIZATION OF AN ELECTRO-OPTIC IMAGING DEVICE FOR REAL TIME MAP PROFILING Final Technical Report, Sept. 1973 - Oct. 1974
P. Nisenson, J. Feinleib, R. A. Sprague, and S. Iwasa 17 Oct. 1974 53 p
(Contract DAAK02-74-C-0029; DA Proj. 4A1-61102-B-52C)
(AD-A005561; ETL-CR-74-18) Avail: NTIS CSCL 20/6

The operation of an electro-optic image modulator and storage device for use in real-time optical processing systems is described. Major emphasis was placed in optimizing the device performance by proper selection of design and operating parameters. The Pockels Read-Out Optical Modulator (PROM) is used to provide temporary storage of an image that can be read into the PROM either sequentially from a laser or CRT scanner or in parallel from a transparency. The PROM is constructed from a thin slice of bismuth silicon oxide, a cubic crystal exhibiting the Pockels effect, photoconductivity when illuminated with blue light, and resistivity sufficient to allow up to 2 hours of charge storage. The crystal slice is oriented normal to (100), polished flat, and coated with an insulating layer of parylene. A dichroic layer, reflecting red light but transmitting blue, is sometimes deposited on one side of the crystal before it is coated with parylene. In the operation of the device, an electric field is first stored in the crystal by inducing surface charges at the crystal-parylene interfaces. The stored image can then be read out by incoherent light or by a laser for coherent optical processing.
GRA

N75-28879# Martin Marietta Aerospace, Orlando, Fla.
ACTIVE OPTICAL SEEKER Final Report
Jun. 1974 65 p refs
(Contract DAAH01-74-C-0412)
(AD-A005668; OR-13195) Avail: NTIS

This report describes a study performed at Martin Marietta Aerospace during the first six months of 1974 on trial designs of an active laser homing system. This active seeker consists of a YAG:Nd laser co-located with a quadrant detector seeker in the nose of a Littlejohn missile airframe. This system is designed to home on a corner cube type retroreflector which is illuminated by the laser. Ruggedness, simplicity and ease of construction are very important considerations, and every effort has been made to make the system inexpensive, consistent with the one mission nature of its use. GRA

N75-28880# Purdue Univ., Lafayette, Ind. School of Electrical Engineering.
ACOUSTIC SURFACE WAVE DEVICES FOR VISIBLE AND INFRARED IMAGING Semiannual Technical Report, 1 Jun. - 30 Nov. 1974
Robert L. Gunshor 1 Jan. 1975 21 p refs
(Grant DAHC15-73-G-12; ARPA Order 2340)
(AD-A005645; SATR-1) Avail: NTIS CSCL 20/6

The objective of this research is the conception, development, and critical evaluation of a new class of devices employing the nonlinear interaction of acoustic surface waves (ASW) and photo-excited charge carriers to achieve rapid-scan optical imaging. The device operating principles are to be demonstrated initially through the use of silicon; however, a major objective is to obtain imaging with infrared radiation using narrow bandgap semiconductors. The experimental effort involves both separate medium and monolithic device configurations. GRA

N75-28881# RCA Labs., Princeton, N.J.
WAVEGUIDES IN LITHIUM NIOBATE-TANTALATE
William Phillips Dec. 1974 38 p refs
(Contract N00014-74-C-0320; NR Proj. 009-01223)
(AD-A004914; IR-1) Avail: NTIS CSCL 20/6

The authors describe the fabrication of diffused lithium niobate tantalate waveguides and define the conditions under which they form. A broad range of processing conditions exists which leads to thin low loss optical waveguides well suited to the fabrication of electrooptic modulators and switches. These waveguides have two additional attributes which are of potential interest in the area of integrated optics. The first is the relative simplicity of their fabrication, which is readily amenable to volume production techniques. The range of acceptable processing parameters is sufficiently broad and noncritical that a high yield of useful devices is likely. Secondly, the waveguides are well suited to photolithographic masking procedures which will facilitate the fabrication of stripe guides, prisms, gratings and other integrated optic circuit elements. GRA

N75-28882# Army Missile Research, Development and Engineering Lab., Redstone Arsenal, Ala.
GLOSSARY OF OPTICAL AND INSTRUMENT TERMS
J. E. Neumann 2 Jan. 1975 93 p
(AD-A005155; RG-75-19) Avail: NTIS CSCL 20/6

This glossary submits terms and definitions peculiar to a system of optics and instruments having applications in guidance, control, and stabilization systems. This report also serves as a ready reference for engineers and technicians requiring such terminology for reporting purposes. GRA

N75-28883# Stanford Univ., Calif. Electronics Labs.
SAMPLING AND RESTORATION OF IMAGES FORMED IN PARTIALLY COHERENT LIGHT
Kalyan Dutta Dec. 1974 143 p refs
(Contract N00014-67-A-0112-0023)
(AD-A004984; SU-TR-6415-7; SU-SEL-74-009) Avail: NTIS CSCL 20/6

In this work, the author gives a new description of the process of image formation by an optical system of a generalized partially coherent object. The imaging of a partially coherent object distribution is considered here as a process of the retransformation of the far-field coherence function due to the object. Based on this approach, the image can be shown to be built up from an incoherent superposition of a number of sinusoidal fringes of intensity. Each such sinusoidal intensity fringe, which we call a Young's interference fringe component, can be obtained from a sampling of the far-field coherence function of the object. The imaging of a partially coherent object is thus considered here from a sampling and image synthesis viewpoint. GRA

N75-28826* Naval Research Lab., Washington, D.C. E. O. Hulbert Center for Space Research.
A CCD IMAGE TRANSDUCER AND PROCESSOR SUITABLE FOR SPACE FLIGHT
Donald J. Michels *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 14-29 refs (For availability see N75-28824 19-70)
CSCL 20F

N75-28827* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
CCD STAR TRACKERS
W. C. Goss *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 31-45 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 03A

N75-28829* Massachusetts Inst. of Tech., Cambridge.
POTENTIAL USEFULNESS OF CCD IMAGERS IN ASTRONOMY
Thomas B. McCord and Jeffrey P. Bosel *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 65-69 refs (For availability see N75-28824 19-70)
CSCL 03A

N75-28831* Maryland Univ., College Park.
ON A PHOTON-COUNTING ARRAY USING THE FAIRCHILD CCD-201
D. G. Currie *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 80-90 refs (For availability see N75-28824 19-70)
CSCL 20F

N75-28832* Princeton Univ. Observatory, N.J.
SOFT X-RAY DETECTION WITH THE FAIRCHILD 100 BY 100 CCD
George Renda and John L. Lowrance *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 91-105 refs (For availability see N75-28824 19-70)
CSCL 20F

N75-28833* General Electric Co., Schenectady, N.Y.
RECENT DEVELOPMENTS IN CID IMAGING
G. J. Michon, H. K. Burke, and D. M. Brown *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 106-115 refs Sponsored by ARPA and AFSC (For availability see N75-28824 19-70)
CSCL 20F

N75-28834* Radio Corp. of America, Lancaster, Pa.
COOLED SLOW-SCAN PERFORMANCE OF A 512 BY 320 ELEMENT CHARGE-COUPLED IMAGER
R. L. Rodgers, III and D. L. Giovachino *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 116-124 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 20F

N75-28835* Texas Instruments, Inc., Dallas.
LARGE-AREA CCD IMAGERS FOR SPACECRAFT APPLICATIONS
G. A. Antcliffe, L. J. Hornbeck, J. M. Younse, J. B. Barton, and D. R. Collins *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 125-136 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 20F

N75-28836* Fairchild Camera and Instrument Corp., Palo Alto, Calif. Research and Development Lab.
A 190 BY 244 CHARGE-COUPLED AREA IMAGE SENSOR WITH INTERLINE TRANSFER ORGANIZATION
L. R. Walsh *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 137-149 ref (For availability see N75-28824 19-70)
CSCL 20F

N75-28837* Electronic Vision Corp., San Diego, Calif.
EXPERIMENTS ON THE USE OF CCD'S TO DETECT PHOTOELECTRON IMAGES
John P. Choisser *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 150-162 refs (For availability see N75-28824 19-70)
CSCL 20F

N75-28838* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DEVELOPMENT OF A CCD FOR ULTRAVIOLET IMAGING USING A CCD PHOTOCATHODE COMBINATION
D. R. Collins (Texas Instruments, Inc., Dallas), C. G. Roberts (Texas Instruments, Inc., Dallas), W. W. Chan (Texas Instruments, Inc., Dallas), W. C. Rhines (Texas Instruments, Inc., Dallas), J. B. Barton (Texas Instruments, Inc., Dallas), and S. Sobieski *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 163-174 refs (For availability see N75-28824 19-70)
(Contract DAAK02-74-C-0359)
CSCL 20F

N75-28839* Fairchild Space and Defense Systems, Syosset, N.Y.
SLOW-SCAN OPERATION OF LONG LINEAR CCD ARRAYS
Michael Vicars-Harris *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 175-185 refs (For availability see N75-28824 19-70)
CSCL 20F

N75-28840* Naval Research Lab., Washington, D.C.
IMAGING PERFORMANCE OF A CCD AREA ARRAY AT 200 K
W. D. Baker and D. J. Michels *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 186-191 (For availability see N75-28824 19-70)
CSCL 20F

N75-28841* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MTF AND POINT-SPREAD FUNCTION FOR A LARGE-AREA CCD IMAGER
K. J. Ando *In its* Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 192-215 refs (For availability see N75-28824 19-70)
(Contract NAS7-100)
CSCL 20F

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.

For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N75-28884 Illinois Univ., Urbana.
THEORETICAL STUDY OF A SPHERICAL INERTIAL ELECTROSTATIC PLASMA CONFINEMENT DEVICE Ph.D. Thesis

David August Swanson 1975 103 p
Avail: Univ. Microfilms Order No. 75-14177

A theoretical analysis was made of the negative potential well formed by electron injection and the multiple potential structure formed by electron-ion injection in spherical geometry. Poisson's equation was modified to include spreads in the particle's total energy, as well as spreads in their angular energy. Solutions were obtained in the electron injection case for both rectangular and Boltzmann energy distributions that agree well with experimental data obtained from a spherical electrostatic confinement device. It is shown that a potential well is formed that has an approximately parabolic radial dependence whose depth depends essentially linearly on injected current and whose depth is relatively independent of the anode voltage for a constant anode current. The solutions for electron-ion injection using rectangular energy distributions also agree with previous experiments. Dissert. Abstr.

N75-28885 Michigan State Univ., East Lansing.
RADIATION AND RESONANCES OF ELECTROACOUSTIC AND IONACOUSTIC WAVES IN COMPRESSIBLE PLASMAS Ph.D. Thesis
Kam-Chi Li 1974 191 p
Avail: Univ. Microfilms Order No. 75-14781

Basic properties of the electroacoustic and ionacoustic waves excited by an electromagnetic source or field in an infinite, homogeneous, isotropic, compressible and lossy plasma, are studied. A two fluid plasma model is employed and this leads to the formulation of the generalized electroacoustic and ionacoustic waves. The radiation patterns of the generalized electroacoustic and ionacoustic waves excited by simple antennas, such as Hertzian dipole, disk monopole, disk dipole and cylindrical antennas, are developed. Also examined are: The excitation of an electroacoustic wave in the plasma sheath surrounding a cylindrical antenna, the excitation of electroacoustic resonances in various plasma geometries, and the reflection behavior of electroacoustic waves on various surfaces. GRA

N75-28886*# Old Dominion Univ., Norfolk, Va.
X-RAY EMISSION FROM HIGH TEMPERATURE PLASMAS Annual Report, 1 Jul. 1974 - 30 Jun. 1975
Wynford L. Harries Jul. 1975 47 p refs
(Contracts NAS1-11707; NAS1-1022; Grants NsG-1022; NGR-43-001-034)
(NASA-CR-143264) Avail: NTIS HC $3.75 CSCL 20I

The bremsstrahlung X-rays from a plasma focus device were investigated with emphasis on the emission versus position, time, energy, and angle of emission. It is shown that low energy X-rays come from the plasma focus region, but that the higher energy components come from the anode. The emission is anisotropic, the low energy polar diagram resembling a cardioid, while the high energy emission is a lobe into the anode. The plasma parameters were considered indicating that even in the dense focus, the plasma is collisionless near the axis. By considering the radiation patterns of relativistic electrons a qualitative picture is obtained, which explains the measured polar diagrams, assuming the electrons that produce the X-rays have velocity vectors lying roughly in a cone between the point of focus and the anode. The average electron energy is about 3keV at the focus and about 10 keV on the anode surface. Results are consistent with the converging beam model of neutron production. Author

N75-28887# Naval Postgraduate School, Monterey, Calif.
MEASUREMENTS OF REFLECTION AND TRANSMISSION IN A LASER-PRODUCED PLASMA M.S. Thesis
Thomas Harold Butler Dec. 1974 68 p refs
(AD-A005471) Avail: NTIS CSCL 20/9

A high energy laser with a pulse width of 30 nsecs (FWHM) irradiated an aluminum target at an angle 30 degrees from the target's normal. The power density at the target's surface was varied between 10 to the 8th power and 10 to the 10th power W/cm squared. Measurements were made of the reflective and transmissive characteristics of the ablated surface particles, and from the measured data, an absorption coefficient was inferred. At intensities greater than 10 to the 9th power W/cm squared the transmitted beam showed a cutoff approximately 25 nsecs after the start of the laser pulse, indicative of the formation of an overdense plasma. All reflection measurements showed that the scattering was primarily specular. At intensities between 10 to the 8th power and 10 to the 9th power W/cm squared, the reflected beam exhibited a narrow pulse attributable to thermal damage at the target surface. At intensities of 10 to the 9th power W/cm squared or greater, the reflected beam also indicated a sharp decrease in amplitude attributed to absorption in the newly-formed plasma. The value of the absorption coefficient was calculated to be 0.545. GRA

N75-28888# Naval Research Lab., Washington, D.C.
FARADAY ROTATION MEASUREMENTS OF MEGAGAUSS MAGNETIC FIELDS IN LASER-PRODUCED PLASMAS Final Report
J. A. Stamper and B. H. Ripin Jan. 1975 13 p refs Sponsored in part by ERDA
(NRL Proj. 77H02-29)
(AD-A005316; NRL-MR-2986) Avail: NTIS CSCL 20/9

Magnetic fields in the megagauss range have been observed in the laser-produced plasma near the focus of a high power laser pulse. Faraday rotation measurements, using the light of a probing beam and the specularly reflected laser light, both show the presence of these large fields. GRA

N75-28889# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
LOW-FREQUENCY OSCILLATIONS IN STATIONARY PLASMA ACCELERATORS
V. I. Brukhtii and N. N. Glotova 4 Oct. 1974 9 p refs Transl. into ENGLISH from the mono. "Plazmennye uskoriteli" Moscow, 1973 p 136-138
(AD-A005127; FTD-HT-23-1063-74) Avail: NTIS CSCL 20/9

In working with lithium, low frequency oscillations were measured on accelerators with an axisymmetrical electrode system. The plasma acceleration process was accompanied by the development of low frequency instabilities in a range of up to 1.5 MHz. This effect produced structural changes in the plasma stream. Author

N75-28890# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
RANDOM WALK SOLUTION TO THE SPHERICAL CONTINUUM ELECTROSTATIC PROBE PROBLEM M.S. Thesis
Kenneth A. Dreyer 6 Dec. 1974 86 p refs
(AD-A005286; GNE/PH/75-5) Avail: NTIS CSCL 20/9

The Monte Carlo random walk numerical technique is developed and applied to the spherical continuum electrostatic probe equations. Random walk theory is treated in detail and its advantages and restrictions are presented. Emphasis is placed upon the algorithm for solution to second order ordinary differential equations. Continuum probe theory is reviewed and a new set of boundary conditions for electron and ion densities at the probe surface is presented. The momentum transport equations are reduced to second order to allow a random walk solution and to delete the explicit appearance of the electron and ion currents. Internal plasma profiles for electron and ion densities and for the voltage, parameterized current-voltage data, and values of current as a function of plasma properties, are presented for the case of equal electron and ion temperatures. GRA

N75-28891# Columbia Univ., New York. Plasma Research Lab.
PARAMETRIC EXCITATION OF PLASMA INSTABILITIES WITH A DENSITY MODULATED RELATIVISTIC ELECTRON BEAM Ph.D. Thesis
Bamandas Basu 1974 117 p refs
(Contract F44620-71-C-0010; AF Proj. 9752)
(AD-A005712; Rept-65; AFOSR-75-0175TR) Avail: NTIS CSCL 20/9

Parametric electrostatic instabilities in a non-relativistic, stationary plasma excited by a monoenergetic, relativistic electron beam with density sinusoidally modulated along the direction of the beam flow have been theoretically investigated using multiple-time-scale perturbation expansion method. The instability occurs due to resonant energy transfer from the negative energy carrying beam-synchronous mode into the positive energy plasma

oscillation mode of a uniform beam-plasma system. The resonant coupling occurs in the presence of the density modulation. The linear growth rate and the width of the unstable spectrum have been determined. It has been found that, for a given beam to plasma density ratio, there exists an upper limit to the initial beam energy for which the instabilities can be excited. GRA

N75-28892# State Univ. of New York, Buffalo. Faculty of Engineering and Applied Sciences.
ELECTRIC ARCS AND SEEDED PLASMAS Final Report, 1 Sep. 1970 - 31 Aug. 1974
David M. Benenson 27 Dec. 1974 25 p refs
(Grant AF-AFOSR-1928-70; AF Proj. 6813; AF Proj. 9752)
(AD-A005715; AFOSR-75-0211TR) Avail: NTIS CSCL 20/9

Experiments and analyses, emphasizing diagnostics (local temperature distributions), have been applied to cross-flow, axial-flow, and seeded plasma configurations. Application of a unique optical system, which permits radiation from the arc to be observed simultaneously at eleven azimuthal angles about the arc column, has permitted the determination of the local temperature distribution for this non-circular (in cross-section) configuration. High speed data acquisition techniques have been applied to determine the local temperatures during the dynamic response of voltage pulsed axial-flow plasmas. The tests carried out upon the cross-flow arc have also detailed the cross-sectional shape and arc profile. GRA

N75-28893# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Physics.
STUDY OF THE ROLE OF VORTEX ANNIHILATION IN THE MECHANISM OF NEUTRON AND X-RAY PRODUCTION IN THE PLASMA FOCUS Final Report
Winston H. Bostick and Vittorio Nardi Jan. 1975 27 p refs
(Grant AF-AFOSR-1842-70; AF Proj. 9752; AF Proj. 6813)
(AD-A005719; SIT-P287; AFOSR-75-0161TR) Avail: NTIS CSCL 20/9

This paper shows that an understanding of the nature of the X-ray and neutron producing processes in the plasma focus requires a study of the fine structure of the plasma focus and that this fine structure study requires diagnostic techniques with spacial resolution down to 50 micrometers and time resolution to about 10 ns. Fortunately it has been possible to develop measuring equipment with these high resolutions. GRA

N75-28894# Naval Research Lab., Washington, D.C.
CIRCUIT DETAILS AND APPLICATION NOTE FOR A VERSATILE PLASMA PROBE Interim Report
Julian C. Holmes and Edward P. Szuszczewicz 31 Dec. 1974 22 p refs
(NRL Proj. A02-11; PR0330242)
(AD-A004952; NRL-7830) Avail: NTIS CSCL 20/9

A plasma-probe circuit has been developed which couples standard Langmuir-probe diagnostic procedures with pulse-mode operation. Circuit versatility provides the means for studying time-dependent phenomena and establishes an improved capability for measuring plasma density and temperature. As an application of the circuit, it is shown that pulse-mode operation reduces the time variance of electrode surface conditions which often cause hysteresis in the Langmuir-probe current-voltage characteristic. GRA

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N75-28895 British Library Lending Div., Boston Spa (England).
DISLOCATION DENSITY IN PURE CRYSTALS GROWN FROM MELT
S. V. Tsibinskii 7 Oct. 1974 45 p refs Transl. into ENGLISH from Russian Report
(BLL-TRANS-889-(9022.64)) Avail: British Library Lending Div., Boston Spa, Engl.: 5 BLL photocopy coupons

The physical reasons for the formation of dislocations in crystals grown by the Czochralski, Stepanov, Kyropoulos, Verneuil, Bridgeman, Stockbarger and floating-zone methods are considered. Equations are presented that allow evaluation, prior to testing, of the dislocation density in pure crystals, and the conditions for obtaining dislocation-free crystals are discussed. Equations for the evaluation of dislocation density are compared with the results of experimental studies of a number of authors. Thermal stresses were proved to be the main cause of the formation of dislocations, and the equations associated with this mechanism in many cases permit prediction of the dislocation density with an error having a factor of 1 - 3. Author

N75-28896 British Library Lending Div., Boston Spa (England).
ETCHING INVESTIGATIONS INTO THE NATURAL CLEAVED FACES OF (Ga, Al) As/Ga As HETEROSTRUCTURES
E. Butter, R. Gunther, B. Jacobs, K. Jacobs, P. Streubel, and A. Zehe 15 May 1974 10 p Transl. into ENGLISH from Krist. Tech. (East Germany) v. 8, no. 9, 1973 p 1021-1028
(BLL-RRE-Trans-428-(8036.625)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

The etching of /110/ cleaved faces of (Ga, Al) As/GaAs heterostructures with and without an additional pn-junction. The etching agents are dilute NHO3 and mixtures of NH3 and H2O2. The lines appearing in the etch patterns are attributed to the related steep changes in the physicochemical features of the crystals. The etch patterns can be correlated with the aluminum concentration profiles throughout the epitaxial layers as obtained by electron microprobe analysis. The optimum temperatures, times and compositions of the etch solutions are given. Preferential etching of GaAs by NH3/H2O2 mixtures is discussed. Author

N75-28897 British Library Lending Div., Boston Spa (England).
THE STABILITY OF FACE-CENTERED CUBIC (AND BODY-CENTRED CUBIC) COORDINATIONS, GROUPINGS AND THE SHORT-RANGE ORDER
E. S. Filippov [1974] 16 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Chernaya Met. (Moscow), no. 3, 1974 p 105-109 In ENGLISH and RUSSIAN
(BLL-M-21964-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 2 BLL photocopy coupons

The relationships of the volumes of molten and solid metals to temperature were analysed. Explanations and proof of the existence of a number of transformations in molten metals are given. The transformations in molten metals found by experiments to take place when they are heated to 600 to 900 C above melting point, provisionally considered to be transition to statistical packing of atoms (structureless liquid), takes place when the volume of the thermal cavities reaches V sub therm, equal to the incompressible volume V sub inc. Author

N75-28898 British Library Lending Div., Boston Spa (England).
ELASTIC MAGNETODIELECTRICS BASED ON FERRITIES
B. E. Levin, N. A. Nazarchik, and B. V. Malegin [1974] 8 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Chern Met. (USSR), no. 3, 1974 p 117-118
(BLL-M-21966-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 1 BLL photocopy coupon

Low-coercitivity elastic ferrites-based magnetodielectrics, 'ferritoelasts', were studied. The dependence was demonstrated of the static-magnetic and electric parameters on the degree of dispersion of the ferrite powder, the ferromagnetic filling coefficient, and the properties of the binding and monolithic ferrite. The nature of the magnetic spectra of the materials investigated was found in relation to the size grading. A decrease in the powder particle size leads to a marked lowering of magnetic losses in the mu sub 0 dispersion region. The maximum absorption of the samples investigated is at the same frequency of about 400 mHz. Author

N75-28899 Illinois Univ., Urbana.
SCATTERING OF MOLECULAR HYDROGEN AND ITS ISOTOPES FROM CRYSTAL SURFACES Ph.D. Thesis
Raymond Grant Rowe 1975 232 p
Avail: Univ. Microfilms Order No. 75-14162

Molecular beam scattering of a thermal beam of H2 from vacuum cleaved (001) surfaces of MgO and LiF, and (111) surfaces of CaF2 and BaF2 was examined along with the scattering of He, D2 and HD and MgO (001). The angular distribution of scattered flux indicates strong molecular diffraction from these

surfaces. These results indicate that the surface structures of the crystals agree with those of the corresponding bulk planes. In addition to elastic diffraction maxima, strong extra peaks were observed for hydrogen and its isotopes. These extra peaks were determined to be the result of a coherent scattering process in which energy is redistributed between the rotational and translational degrees of freedom of the molecule. The redistribution of energy in this transition occurs with no energy interaction with the crystal lattice. Qualitative estimates indicate that for HD scattering, the total flux of molecules undergoing rotational transitions is comparable to the flux into the strong first order elastic diffraction peaks. Dissert. Abstr.

N75-28900 Illinois Univ., Urbana.
LOW TEMPERATURE ANOMALIES IN NIOBIUM, VANADIUM AND TANTALUM Ph.D. Thesis
Gregory Jude Sellers 1975 175 p
Avail: Univ. Microfilms Order No. 75-14169

The specific heats of superconducting Nb, V, and Ta and of normal Ta were measured in the temperature range 0.05-2 K in an outgassed condition and with H or D added as interstitial solutes. The presence of H or D in these bcc transition metals produces an isotope dependent specific heat anomaly which can dominate the normal lattice contribution and which appears to be related to a displacive motion of the interstitial H or D. The thermal conductivities of superconducting Nb and Ta samples were also measured in the temperature range 0.04-4 K, both outgassed and with dissolved H or D. The presence of H or D results in a decrease of the thermal conductivity. In Nb doped with D the phonon mean free path exhibits a minimum which occurs at the same temperature at which a deuterium related anomaly has been observed in the specific heat. A technique was developed which permits the accurate measurement of heat capacities to very low temperatures without the use of a heat-switch. Dissert. Abstr.

N75-28901 Georgetown Univ., Washington, D.C.
THEORY OF THE ELECTRIC CURRENT TRANSMISSION COEFFICIENT IN THE SUPERCONDUCTOR-INSULATOR-SUPERCONDUCTOR GEOMETRY Ph.D. Thesis
Rassmidara Navani 1974 180 p
Avail: Univ. Microfilms Order No. 75-14877

Tunneling in the superconductor-insulator-superconductor (S prime-I-S) geometry, where the two superconductors are not necessarily the same, was studied theoretically. Two different models of the S prime-I-S geometry - which we call the "initial model" and the "improved model" - are discussed. For the initial model the potential barrier is flat. In the improved model, the differing material properties of the three regions - S prime, I and S - are taken into account in an approximate fashion. Applied, contact, and image potentials in the insulator are included. The solid state material properties that are taken to be different are the effective electronic masses in the three regions and the Fermi energies in the two superconductors. The quasiparticle wave functions in the S prime, I, and S regions were determined for both models as solutions to the Bogoliubov-de Gennes equations. The electric current transmission coefficients (also the reflection coefficient for the initial model) are derived and their behavior is extensively analyzed. Dissert. Abstr.

N75-28902 Delaware Univ., Newark.
VARIATIONS IN THE SPECTRAL DISTRIBUTION OF PHOTOCONDUCTIVITY OF CADMIUM SULFIDE CRYSTALS AS A FUNCTION OF THE CRYSTAL GROWTH CONDITIONS Ph.D. Thesis
Lodewijk VanDenberg 1975 117 p
Avail: Univ. Microfilms Order No. 75-14978

Single crystal platelets of cadmium sulfide were grown by means of the vapor transport technique, using an atmosphere consisting of nitrogen with a few percent hydrogen sulfide. Changes were made in the concentration of hydrogen sulfide in the carrier gas during the growth and at various stages of the cool-down. The spectral distribution of photoconductivity of the crystals was measured at both liquid nitrogen and room temperatures. The experimental data were explained qualitatively on the basis of the electronic properties of optically active native defects, in particular cadmium vacancy centers. Both the recombination characteristics of the different charge states of these centers and the possibility of bound exciton formation were considered. Results indicate that variations in the spectral distributions of photoconductivity, are from changes in the native defect concentrations, and can be correlated with variations in the conditions of crystal preparation. Dissert. Abstr.

N75-28903 California Inst. of Tech., Pasadena.
PROXIMITY EFFECT IN Ag-Pb ALLOYS Ph.D. Thesis
Yen-Shen Edmund Sun 1975 145 p
Avail: Univ. Microfilms Order No. 75-9541

The superconducting properties and the microstructure of the Ag100-xPbx alloys, 1 smaller than or equal to x smaller than or equal to 5, prepared by rapid quenching from the liquid state with and without subsequent heat treatments, have been studied. The X-ray diffraction measurements show that supersaturated solid solutions of Pb in Ag can be obtained up to 3.2 at.% Pb as compared to less than 0.1 at.% Pb at equilibrium. It was found that by suitable heat treatment it is possible to vary the size and distribution of the Pb precipitates in the Ag matrix and reproducible superconducting properties in the alloy can be observed. The superconducting transition temperature of these samples can be qualitatively explained by the Silvert and Singh's theoretical calculation. The critical current versus field behavior of these alloys can be explained by modification of the Josephson effect. It is concluded that the three-dimensional proximity effect is the main mechanism for the superconductivity in the Ag-Pb alloys. Dissert. Abstr.

N75-28904 Catholic Univ. of America, Washington, D.C.
STUDY OF THE ELECTROMAGNETIC INTERACTION IN SUPERCONDUCTOR NEAR Tc IN PRESENCE OF SMALL MAGNETIC FIELD: NEW QUASIPARTICLE EXCITATION SPECTRUM IN THE ACOUSTIC ATTENUATION IN THE INTERMEDIATE STATE OF A SUPERCONDUCTOR Ph.D. Thesis
Fong-Jen Lin 1975 100 p
Avail: Univ. Microfilms Order No. 75-14962

Quasiparticle scattering at N-S interfaces in the intermediate state leads to a modified quasiparticle energy spectrum. We report finding this spectrum in the acoustic attenuation in In near T sub c. A theoretical model is given which accounts for the observed attenuation structure in terms of the modification of the density-of-states rho(E) produced by the N-S superlattice. Unique conditions in the present work have led to discovery of the new features: Since T sub c - T approximately less than 5 mK acoustic phonon energy Dirac h omega approximately 0.01 standard temperature, the BCS energy gap. We find this energy to be comparable with the band width and band separation in the new quasiparticle energy spectrum just above standard temperature, so that modified rho(E) can have measurable effect on the observed attenuation due to phonons of energy Dirac h omega. The observed temperature dependence of the attenuation structure is shown to be in good agreement with that determined from the theoretical model using the new quasiparticle density-of-states. Dissert. Abstr.

N75-28905 Yale Univ., New Haven, Conn.
DISPERSION RELATIONS AND FERROMAGNETIC RESONANCE Ph.D. Thesis
Yuan-Jye Lu 1974 242 p
Avail: Univ. Microfilms Order No. 75-15329

Dispersion relations and their physical consequences for anisotropic ferromagnetic metals, and their characteristic propagating waves were studied. The analytic treatment of four dispersion branches near a Larmor resonance and antiresonance for arbitrary set of pinning and material parameters was studied. Field-sweep dispersion relations were developed. A large number of perspective views of three-dimensional dispersion curves for significant materials in a quantitative representation are presented. A perturbation approach to the resonance absorption in a microwave cavity which describes resonance absorption adequately without much involvement in surface impedances is also presented. Quantitative results show explicitly the characteristics of the dispersion relations on the absorption spectra. Dissert. Abstr.

N75-28906 Yale Univ., New Haven, Conn.
TWO-PHONON RESONANCE RAMAN SCATTERING WITH

Si AND ELECTRONIC RAMAN SCATTERING WITH ErIG Ph.D. Thesis
Jin-Joo Song 1974 151 p
Avail: Univ. Microfilms Order No. 75-15358

Dispersion of the scattering cross sections for one- and two-photon Raman scattering has been investigated when the incident photon energy approaches the direct or indirect gap of semiconductors from below. The calculations on scattering amplitudes were carried out using free electron hole approximation. For two phonon Raman scattering the two dominant processes were considered separately. Only one of the processes exhibits an enhancement of two phonons when near resonance condition is achieved with the indirect gap. Resonance with the direct gap causes both of the two dominant processes to show enhancement of the entire Raman spectrum and particularly the two phonons. The frequency and symmetry of Raman active phonons were determined in DyIG, ErIG, YbIG and YIG at LN2 temperature. Measurements were made both in reflection, using an argon laser, and in transmission, using a CW Nd:YAG laser. Dissert. Abstr.

N75-28907 Yale Univ., New Haven, Conn.
EXCITON STATICS AND DYNAMICS IN MOLECULAR CRYSTALS Ph.D. Thesis
Frank Bernard Tudron 1974 147 p
Avail: Univ. Microfilms Order No. 75-15379

Problems involving exciton statics and dynamics in molecular crystals were investigated. The mechanism of triplet energy transfer in isotopic mixed crystals of benzene was studied. It was found that the probability for trap-to-trap transfer is a function of trap depth. The shallower the trap, the more probable the transfer. Hence, the transfer mechanism appears to be governed by exciton super-exchange effects. The effect of the crystalline environment on the properties of molecules was investigated. Measurements of the phosphorescence lifetimes of various deuterated benzenes in benzene-d(6) and in borazine indicate the presence of an intermolecular effect on the radiative decay rate. The effect of the environment on the S(1)-S(0) transition energy of benzene in various matrices was considered. The fluorescence spectrum of benzene-h(6) in benzene-d(6) is reported and analyzed. Gas-to-crystal shift data from this system and others was obtained, and the importance of crystal packing in determining the shift was demonstrated. Dissert. Abstr.

N75-28908 Washington Univ. Hospital, Seattle.
ULTRASONIC RESONANCE AND NON-RESONANCE STUDIES OF SINGLE CRYSTAL TANTALUM WITH KNOWN HYDROGEN IMPURITIES Ph.D. Thesis
Tien-her Wang 1974 105 p
Avail: Univ. Microfilms Order No. 75-14912

Tantalum single crystals charged with low hydrogen concentrations C (C = the atomic ratio of H to Ta ranges from 0.000 to 0.0267) were studied using nuclear acoustic resonance techniques and background ultrasonic attenuation measurement in the temperature range 78K to 300K. Acoustic waves of 10MHz and 5MHz were propagated along the cylindrical axes of the samples, which were the /110/ axes. The polarization direction was along the /1(-1)0/ or the /001/ axis for 10MHz transverse waves and was along the /1(-1)0/ axis for 5MHz transverse waves. Longitudinal waves of 10MHz were also used. In the NAR experiments, the magnetic field was rotated either in the /110/ or the /1(-1)0/ plane. Dissert. Abstr.

N75-28909 Southern Methodist Univ., Dallas, Tex.
THE MEASUREMENT OF ULTRASONIC ATTENUATION IN DIELECTRIC SOLIDS USING THE METHOD OF BRAGG SCATTERING AND ULTRASONIC ATTENUATION IN NEMATIC LIQUID CRYSTALS IN A MAGNETIC FIELD Ph.D. Thesis
Royce Stephen Speer 1974 234 p
Avail: Univ. Microfilms Order No. 75-15279

The method of Bragg scattering of laser light by microwave-ultrasonic waves was used to measure the attenuation of longitudinal waves in calcium fluoride and X-cut quartz at room temperature and frequencies from 1 to 2 GHz. The corrected values of the attenuation for propagation along (100), (111), and (110) directions in CaF2 are 1.23 + or - .05, 1.77 + or - .07, and 2.03 + or - .08 (dB/cm-GHz sq), respectively. The experimental results are compared with two theories of ultrasonic attenuation; qualitative agreement was obtained, but neither theory correctly predicts the relative anisotropy in the attenuation along the three major axes of CaF2. The experimental results show that the attenuation of longitudinal waves is inversely related to the degree of symmetry along the axis of propagation. Numerical values for correction due to diffraction of the ultrasonic beam are included along with the calculations of loss due to off-axis propagation. Preliminary results of harmonic generation in (110) CaF2 are also presented. Dissert. Abstr.

N75-28910 Missouri Univ., Columbia.
EXPERIMENTAL STUDY OF THE STABILITY OF THE Si-SiO2 INTERFACE Ph.D. Thesis
Fu-Shing Chang 1974 144 p
Avail: Univ. Microfilms Order No. 75-15974

The degree of cleanliness of each processing step in MOS transistor fabrication was investigated. It was found that most of the mobile ions present in the gate insulator were included after the oxidation stage. Based on this fact, a double metallization process was developed. In this process, a clean aluminum layer is immediately deposited on the fresh oxide surface to protect it from contamination. Variations in MOS transistor characteristics caused by surface states, fixed oxide charges and mobile ions were studied. The density of mobile ions in MOS devices made by the new process is two orders of magnitude lower than in those made by th3 conventional process. In most cases, both fast surface states and fixed oxide charges are considerably reduced by low temperature (460 C) annealing in a hydrogen atmosphere. A cheaper silicon humidity sensor was designed which can measure from 10 to 90% R.H. with better than 1% accuracy. Dissert. Abstr.

N75-28911 Michigan State Univ., East Lansing.
THE MAGNETIC BEHAVIOR OF SEVERAL TRANSITION METAL SALTS; SOME LOW DIMENSIONAL EFFECTS Ph.D. Thesis
Charles Ralph Stirrat 1974 120 p
Avail: Univ. Microfilms Order No. 75-14839

Low temperature magnetic measurements are reported on three transition metal salts, ((CH3)3NH)CuCl3 x 2H2O, ((CH3)-NH) CoCl3 x 2H2O, and NiI2 x 6H2O. These measurements include electron spin resonance, nuclear magnetic resonance, and magnetic susceptibility in zero and applied field. The experimental results were interpreted in terms of existing theories. Trimethylamine copper chloride orders magnetically at Tc = 0.157 + or - 0.003 K. Above the transition the susceptibility is given by the high-temperature expansion for a two-dimensional square Heisenberg lattice. Below Tc the crystal exhibits behavior characteristic of weak antiferromagnetic coupling between the ferromagnetic layers. The successive spins along a are canted slightly away from a due to the presence of two inequivalent anisotropic g-tensors. The magnetic susceptibility of trimethylamine cobalt chloride in the order state exhibits metamagnetic behavior. Nickel iodide hexahydrate orders magnetically at Tc = 0.120 K. Dissert. Abstr.

N75-28912 Yale Univ., New Haven, Conn.
CROSSED BEAM STUDIES OF SOME SIMPLE IONOSPHERIC AND ORGANIC ION-MOLECULE REACTIONS Ph.D. Thesis
Gregory Paul Kenneth Smith 1974 196 p
Avail: Univ. Microfilms Order No. 75-15376

Isotope labeling and crossed molecular beam techniques were applied to study angular, energy, and mass distributions of the products of various ion neutral reactions as a function of ion kinetic energy above 1 ev. Reaction dynamics and relative isotopic cross sections were examined. The product distributions of the reaction O(+)4S + N2 yields NO(+) - (X1 sigma +) + N(4S) are generally described by the spectator stripping model, with no evidence for a persistent complex or second mechanism. The effect of substituting nitrogen for carbon was examined in a number of methane ammonia systems. Ammonium ions formed from CH4(+) + NH3 peak at two velocities forward of the center of mass. The products of greater translational energy are no longer formed at high collision energies. Both NH4(+) and the other ion product, CNH5(+), show no hydrogen scrambling. The processes NH2(+) + CH4 or CH3(+) + NH3 CNH4(+) +

2H exhibit limited isotope scrambling and the isotopic products have kinematic differences. Dissert. Abstr.

N75-28913 Washington Univ., Seattle.
THE EFFECT OF CHEMICAL EXCHANGE ON ELECTRON SPIN LATTICE RELAXATION TIME Ph.D. Thesis
Cheupyeng Cheng 1974 115 p
Avail: Univ. Microfilms Order No. 75-14895

The effect of chemical exchange on electron spin lattice relaxation time is investigated by using the Bloch equations. It is found that in the slow exchange limit the effect on T sub 1 is almost the same as on T sub 2 and in the fast exchange limit the effective spin lattice relaxation time is the intrinsic spin lattice relaxation time of the radical ion. These results have been tested experimentally on KTCNE and TCNE in DME system. The electron spin lattice relaxation times are measured by the successive saturation method. There is good agreement between theory and experiment. Dissert. Abstr.

N75-28914 Illinois Univ., Urbana.
TOPICS IN THE THEORY OF CONDENSED MATTER: DIFFUSION THERMOELECTRIC POWER IN THE ALKALI METALS AND ELECTROABSORPTION BY ACOUSTOELECTRIC DOMAINS Ph.D. Thesis
Marshall Allen Bowen 1975 164 p
Avail: Univ. Microfilms Order No. 75-14085

A calculation of the high temperature diffusion thermoelectric power as a function of pressure was carried out for Li, Na, and K using a rigid-ion model and the Born approximation to the electron-phonon scattering. By assuming the validity of the Boltzman equation in the relaxation-time approximation, an expression for the electronic mean-free-path was obtained. Required in the calculation were pseudopotentials, which represent the electron-single ion interaction, and structure factors, which contain information about the positions of the ions. The transport coefficient were expressed as integrals over the Fermi surface, which were numerically carried out. The absorption of light by mature acoustoelectric domains was studied. Results show that the agreement between theory and experiment for the resistivities and Hall coefficients are good, and that the theory correctly predicts the magnitudes pressure dependences of the data. The importance of the electron-hole interaction is demonstrated and the magnitude of the electric field in the acoustoelectric domains is given. Dissert. Abstr.

N75-28915 Illinois Univ., Urbana.
MODEL FOR AN EXCITON MECHANISM OF SUPERCONDUCTIVITY IN PLANAR GEOMETRY Ph.D. Thesis
David William Allender 1975 81 p
Avail: Univ. Microfilms Order No. 75-14075

Upon specialization to the case of the single interface between a thin, crystalline metal film in intimate contact with a clean semiconductor substrate, a model was developed in which the metal electrons with energies near the Fermi surface penetrate a short distance into the semiconductor. There they scatter by producing and absorbing virtual electron-hole pairs. The effect of such semiconductor polarization processes (the exciton mechanism) on the electron-electron interaction is estimated by two separate means and is found to lead to an attractive interaction for favorable choices of semiconductor and metal materials. A calculation of what superconducting transition temperatures one could expect to see due to this effect follows, both for the case of the exciton mechanism acting alone, and for the case of the exciton mechanism combined with the usual phonon mechanism. Dissert. Abstr.

N75-28916 Yale Univ., New Haven, Conn.
POLARIZATION SELECTION RULES FOR THE DOUBLE-MOLECULAR TRANSITIONS IN SOLID ALPHA PRIME OXYGEN Ph.D. Thesis
Cardinal Warde 1974 141 p
Avail: Univ. Microfilms Order No. 75-15384

A thin oriented film of solid alpha-prime oxygen was grown on a thin transparent substrate, and the polarization selection rules governing the double-molecule optical transition were determined. This was accomplished by combining total internal reflection spectroscopy with a multiple beam interference technique. Interference patterns were used to determine the thickness and the indices of refraction of the birefringent film. Orientation of the molecules was determined by comparing the measured indices with the calculated indices for the possible orientations. Selective absorption was also observed. It was found that alpha-prime oxygen grows on a smooth amorphous substrate as a uniaxial crystal in which all the internuclear axes are parallel to the substrate. It was also found that the main contribution to the intensity of the (0-0) band comes from light polarized in the plane perpendicular to the optic axis. Dissert. Abstr.

N75-28917 British Library Lending Div., Boston Spa (England).
THE INFLUENCE OF VERY LOW TEMPERATURE ON THE RADIATION DAMAGE OF ORGANIC CRYSTALS IRRADIATED BY 100 keV-ELECTRON
G. Siegel [1974] 28 p Transl. into ENGLISH from Zeitschrift fuer Naturforsch. (Tuebingen), v. 27a, no. 2, Feb. 1972 In ENGLISH and GERMAN
(BLL-M-23454-(5828.4F)) Avail: British Library Lending Div., Boston Spa, Engl.: 3 BLL photocopy coupons

Radiation damages of organic materials under electron irradiation in the range of 4 to 300 K were measured. Two simple organic compounds with a type of bond characteristics of a number of other molecules were chosen as test substances: paraffin as an example of an aliphatic bond, and naphthacene as an example of an aromatic bond. Since radiation damages also hinder the observation of living substances during significant enlargement under the electron microscope, biological objects were also examined along with organic crystals.
Author

N75-28918+ Societe Generale de Constructions Electriques et Mecaniques Alsthom, Massy (France). Dept. Semiconducteurs.
DEPOSITION OF TUNGSTEN IN VAPOR PHASE FROM TUNGSTEN HEXAFLUORIDE Final Report [DEPOSITION DE TUNGSTENE EN PHASE VAPEUR A PARTIR D'HEXAFLUORURE DE TUNGSTENE]
R. Barandon 29 Apr. 1974 49 p refs In FRENCH
(Contract DGRST-71-7-2965)
Avail: NTIS HC $3.75

Tungsten layers adherent to silicium are obtained by reducing tungsten hexafluoride at 500 to 700C. The interface layers exhibit a fair percentage of fluorine and silicon. A silicide at the interface would justify the low contact resistance measured. On the other hand, using a tungsten layer of a few microns as a barrier against penetration of the eutectic aluminum-silicon when allying a semiconductor to a solid tungsten electrode (power semiconductors) was tried out. ESRO

N75-28919 Compagnie Generale d'Electricite, Marcoussis (France). Dept. Recherches Physiques de Base.
GROWTH STUDY OF SINGLE CRYSTALS WITH HIGH FIGURE OF MERIT FOR ACOUSTO-OPTICS USING THE CZOCHRALSKI METHOD Final Report [ETUDE DE LA CROISSANCE SELON LA METHODE DE CZOLCHRALSKI DE MONOCRISTAUX A HAUT FACTEUR DE MERITE POUR L'ACOUSTO-OPTIQUE]
Claude Brehm and Gerard Villela 31 May 1974 54 p refs In FRENCH
(Contract DGRST-73-7-1451)
Avail: Issuing Activity

Lead molybdates (Pb2MoO5) monocrystals were studied using the Czochralski method. Drawing parameters and defect elimination such as cleavage and orientation faults were investigated. Physical properties, such as transmission spectra, plastic deformation, and figures of merit in two directions of use were measured. ESRO

N75-28920+ Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
FERRIMAGNETIC POLYCRISTALLINE GARNETS WITH LINEWIDTHS LOWER THAN 20 OERSTEDS Final Report [ETUDE DE GRENATS FERRIMAGNETIQUES POLYCRISTALLINS A LARGEURS DE RAIES INFERIEURES A 20 OERSTEDS]
Roland Sroussi Jun. 1974 29 p refs In FRENCH; ENGLISH summary
(Contract DGRST-73-7-1356)
(LCR-950/74) Avail: NTIS HC $3.75

The magnetic and dielectric properties of ferrimagnetic polycrystalline garnets chosen for the low magnetocrystalline anisotropy are presented. The saturation magnetization values lie between 500 and 1.900 G with Curie point higher than 120 C. The formation of these garnets was studied, and materials with low residual porosity were obtained. The resultant gyromagnetic line-widths were found lower than 20 Oe. The effective linewidth, spin-wave linewidths, and dielectric properties in X-band are given. ESRO

N75-28921+ Laboratoire Central de Recherches Thomson-CSF, Orsay (France).
INTERFACE DEFECTS CHARACTERIZATION BY ELECTRONIC PARAMAGNETIC RESONANCE Final Report [CARACTERISATION DES DEFAUTS D'INTERFACE PAR RESONANCE PARAMAGNETIQUE ELECTRONIQUE]
D. Kaplan, R. Poirier, and N. Szydlo Aug. 1974 26 p refs In FRENCH
(Contract DGRST-73-7-1463)
(LCR-086/025) Avail: NTIS HC $3.75

A thin plate of silicon in the presence of magnetic and RF field exhibits a resonant photoconductivity variation together with surface potential variation. This effect was studied in the case of the Si-SiO2-interface and was attributed to surface paramagnetic centers. The interface was electrically characterized and the photoconductivity variation measured. It was shown that the responsible centers are in equilibrium with the valency band. A physical model explains the non observation of the surface potential variation. For MOS structures, the direct detection of the paramagnetic centers is at the limit of sensitivity of conventional spectrometers. ESRO

N75-28922+ Radiotechniques S. A., Caen (France). Div. Industrielle et Technique.
PHYSICAL STUDY OF EXCITON RECOMBINATION LINKED WITH ISOELECTRONIC CENTERS IN GaP AND Ga Px As(1-x) (0.5 LESS THAN x LESS THAN OR EQUAL TO 1) Final Report [ETUDE PHYSIQUE DES RECOMBINAISONS D'EXCITONS LIES A DES CENTRES ISOELECTRONIQUES DANS LE GaP ET Ga P x As(1-x) (0,5 LESS THAN x LESS THAN OR EQUAL TO 1)]
D. Diguet, M. Gaffre, and J. Varon 26 Sep. 1974 53 p refs In FRENCH
(Contract DGRST-73-7-1072)
Avail: NTIS HC $4.25

The luminescent properties of isoelectronic nitrogen centers in phosphor doped gallium phosphide are studied. Epitaxy and crystal growth techniques and procedures are detailed leading to high purity materials of controlled composition and dopant concentration. The dependence of spectra and light intensity as a function of band composition and isoelectronic center concentration is discussed. A simple physical model based on the bond energy of the various centers is developed. ESRO

N75-28923*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HYBRID THEORY AND CALCULATION OF e-N2 SCATTERING
N. Chandra and A. Temkin Jun. 1975 54 p refs
(NASA-TM-X-70935; X-602-75-163) Avail: NTIS HC $4.25 CSCL 20L

A theory of electron-molecule scattering was developed which was a synthesis of close coupling and adiabatic-nuclei theories. The theory is shown to be a close coupling theory with respect to vibrational degrees of freedom but is a adiabatic-nuclei theory with respect to rotation. It can be applied to any number of partial waves required, and the remaining ones can be calculated purely in one or the other approximation. A theoretical criterion based on fixed-nuclei calculations and not on experiment can be given as to which partial waves and energy domains require the various approximations. The theory allows all cross sections (i.e., pure rotational, vibrational, simultaneous vibration-rotation, differential and total) to be calculated. Explicit formulae for all the cross sections are presented. Author

N75-28924# Technische Universitaet, Munich (West Germany).
MEASUREMENTS OF THE DEBYE-WALLER FACTORS AND OF THE LATTICE PARAMETERa ON H2O-ICE-Ih SINGLE CRYSTALS BETWEEN 90 AND 230 K Ph.D. Thesis [MESSUNG DES DEBYE-WALLER-FAKTORS UND DES GITTERPARAMETERSa AN H2O-EIS-Ih-EINKRISTALLEN ZWISCHEN 90 UND 230 K]
Helmut Haltenorth 18 Sep. 1974 70 p refs In GERMAN
Avail: NTIS HC $4.25

Debye Waller factor measurements on pure H2O ice Ih single crystals, as well as lattice parameter measurements on HF doped H2O ice Ih single crystals, established a first order phase transformation with hysteresis between 110 and 210 K. The phase transformation seemed to be dominated by heterogenous nucleation and a relaxation time of several days. Minima in the Debye Waller factur curve indicate the development of a soft mode with an increase in median oscillation amplitudes in the ice lattice around T sub c. A proton ordering ice lattice is proposed for growing nuclei structures below T sub c. Transl. By G.G.

N75-28925*# Scientific Translation Service, Santa Barbara, Calif.
ANTIGORITE: STRUCTURAL THEORETICAL FUNDAMENTALS AND THEIR PRACTICAL IMPORTANCE FOR FURTHER SERPENTINE RESEARCH
G. Kunze Washington NASA Jul. 1975 212 p refs Transl. into ENGLISH from Fortschr. Mineral. (West Germany), v. 39, no. 2, Sep. 1971 p 206-324
(Contract NASw-2483)
(NASA-TT-F-16406) Avail: NTIS HC $7.25 CSCL 20B

By structure-geometrical considerations it is shown that the procrystalline curvature of the antigorite layers after nucleation is responsible for the wavelengths of the layers (superperiods) in the crystalline state. The discrete superperiod series, which have originally only been postulated are proved experimentally for a great range of m (m = number of tetrahedrons per superperiod). Below this existence range the antigoritical structure principle is impossible to be realized, and above it the probability for the formation of a single superperiod becomes too small. Therefore, antigorite layers with statistically mixed superperiods can be expected in the long wave range. Higher classes of superstructures in the range of 100 A were isolated. Author

N75-28926*# RCA Labs., Princeton, N.J.
SEMICONDUCTOR DIODE LASER MATERIAL AND DEVICES WITH EMISSION IN VISIBLE REGION OF THE SPECTRUM Final Report
I. Ladany and H. Kressel Washington NASA Jul. 1975 143 p refs
(Contract NAS1-11421)
(NASA-CR-2556; PRRL-75-CR-74) Avail: NTIS HC $5.75 CSCL 20L

Two alloy systems, (AlGa)As and (InGa)P, were studied for their properties relevant to obtaining laser diode operation in the visible region of the spectrum. (AlGa)As was prepared by liquid-phase epitaxy (LPE) and (InGa)P was prepared both by vapor-phase epitaxy and by liquid-phase epitaxy. Various schemes for LPE growth were applied to (InGa)P, one of which was found to be capable of producing device material. All the InGaP device work was done using vapor-phase epitaxy. The most successful devices were fabricated in (AlGa)As using heterojunction structures. At room temperature, the large optical cavity design yielded devices lasing in the red (7000 A). Because of the relatively high threshold due to the basic band structure limitation in this alloy, practical laser diode operation is presently limited to about 7300 A. At liquid-nitrogen temperature, practical continuous-wave operation was obtained at a wavelength of 6500 to 6600 A, with power emission in excess of 50 mW. The lowest pulsed lasing wavelength is 6280 A. At 223 K, lasing was obtained at 6770 A, but with high threshold currents. The work dealing with CW operation at room temperature was successful with practical operation having been achieved to about 7800 A. Author

N75-28927# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
MOSSBAUER EFFECT APPLICATION Final Report, 1 Jan. - 31 Dec. 1973
Sergio DeBenedetti and William T. Oosterhuis 12 Feb. 1975 14 p refs
(Contract N00014-67-A-0314-0005)
(AD-A005422) Avail: NTIS CSCL 07/4

An accounting of the past 13 years of research on the Mossbauer effect is presented in the form of a list of publications and of doctoral theses. GRA

N75-28928# Colorado State Univ., Fort Collins. Dept. of Physics.
SURFACE AND BULK CHARGE CARRIER TRANSPORT IN InAs EPILAYERS
J. R. Sites and H. H. Wieder 31 Jan. 1975 19 p refs
(Contract N00014-67-A-0299-0017; NR Proj. 372-305)
(AD-A005639; SF4) Avail: NTIS CSCL 20/12

The purpose of this study was to characterize the electrical properties of InAs single crystal epilayers over a temperature range from 4K to 300K and to determine the effect of the surface transport characteristics on the measured galvanomagnetic parameters. The technique used was to measure the magnetic field dependence of the Hall coefficient and the conductivity of the various temperatures. The extra information from the variation of Hall coefficient with field allows one to separate the surface from the bulk properties of the epilayer. GRA

N75-28929# Northwestern Univ., Evanston, Ill. Materials Research Center.
BASIC AND APPLIED RESEARCH IN MATERIALS Annual Technical Report, 1 Jun. 1973 - 31 May 1974
J. Bruce Wagner, Jr. 31 May 1974 33 p refs
(Grant DAHC15-73-G-19; DARPA Order 2379)
(AD-A004883) Avail: NTIS CSCL 20/12

This report covers the period from 1 June 1973 through 31 May 1974 and describes the research carried out in four major areas: (1) Materials for Energy Storage, (2) Heterogeneous Catalysis, (3) Maximization of Electret Effect in Polyacrylonitrile Films and (4) Properties of Foils Containing Very Short Wavelength Composition Modulations. GRA

N75-28930# Army Foreign Science and Technology Center, Charlottesville, Va.
THERMOELECTRIC POWER AND ETTINGSHAUSEN-NERNST COEFFICIENTS OF RHENIUM AND METALS OF THE PLATINUM GROUP
V. F. Nemchenko, S. N. Lvov, P. I. Malko, and V. N. Deliev 26 Mar. 1974 12 p refs Transl. into ENGLISH from Fiz. Metal. Metalloved. (USSR), v. 33, no. 3, 1972 p 540-545
(AD-A005204; FSTC-HT-23-1589-73) Avail: NTIS CSCL 20/12

The temperature dependence of the absolute thermoelectric power coefficient was studied for rhenium, osmium, iridium and platinum, at 100-1300K. The Ettingshausen-Nernst coefficients were determined at room temperature. The measurement results are compared with the nature of the density function of the d-state at the Fermi level. The observed thermoelectric power is composed of relaxation and concentration components. The sign of the latter is compared with the sign of the Hall coefficient. GRA

N75-28931# Army Foreign Science and Technology Center, Charlottesville, Va.
INVESTIGATION OF HIGH-VOLTAGE PHOTOVOLTAIC EFFECT AND PIEZOEFFECT IN THIN CdTe FILMS DEPENDING ON THEIR STATE
V. B. Tolutis and V. V. Yasutis 26 Oct. 1974 9 p refs Transl. into ENGLISH from Lietuvos Fiz. Rinkinys, Lietuvos TSR Mokslu Akad. Lietuvos TSR Aukstosios Mokyklos (Vilnyus), v. 10, no. 2, 1970 p 271-277
(AD-A005211; FSTC-HT-23-204-75) Avail: NTIS CSCL 20/12

The article studies the dependence of the high-voltage photovoltaic effect (HVPVE) and piezoeffect on the state of the thin CdTe film crystalline structures. The properties of the macro- and microstructure of thin CdTe films with different polarities of the HVPVE are established. The change of sign of the HVPVE is not connected with the change in the polarity of the piezoeffect. GRA

N75-28932# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH-TEMPERATURE X-RAY RESEARCH ON A(2)B(4)C(5)2 COMPOUNDS
I. I. Kozhina and A. S. Borshchevskii 26 Nov. 1974 16 p refs Transl. into ENGLISH from Vestn, Leningrad. Univ. (USSR) v. 22, no. 4, 1971 p 87-92
(AD-A005682; FTD-MT-24-2672-74) Avail: NTIS CSCL 20/12

High temperature X-ray photographs were used to investigate phase transformations in A2B4C5 sub 2 semiconductor compounds. In high temperature research information can be obtained by measuring the coefficients of thermal expansion in various crystallographic directions which makes it possible to establish the nature of phase transformations. Debye temperature of crystals and Grueneisen's constant are also discussed. M.J.S.

N75-28933# Dayton Univ. Research Inst., Ohio.
EXPLORATORY DEVELOPMENT ON LASER AND OPTICAL MATERIALS Final Report, 1 Dec. 1972 - 15 Aug. 1974
J. Michael Ohare, John A. Detrio, Roger D. Petty, and Perry P. Yaney Dec. 1974 69 p refs
(Contract F33615-73-C-5009; AF Proj. 7371)
(AD-A005385; UDRI-TR-74-41; AFML-TR-74-235) Avail: NTIS CSCL 20/12

Contents: Analytical solid state material studies -- (Theoretical and experimental investigations of the optical Stark spectra of rare earth ions, Judd-Ofelt theory, Quantum efficiencies); Laser materials evaluation; Studies of rare-earth doped CdF2, SrF2, and BaF2 -- (Electroluminescence of semiconducting CdF2, Analyses of the optical spectra of Gd(3+) and Ce(3+)). GRA

N75-28934# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESEARCH ON CERTAIN ELECTROPHYSICAL PROPERTIES OF SULFONATED CARBON FIBERS
G. N. Savastenko and I. N. Ermolenko 26 Nov. 1974 13 p refs Transl. into ENGLISH from Vestsi Akad. Navuk BSSR, SSR, Ser. Khim. Navuk (USSR), no. 1, 1971 p 36-40
(AD-A005518; FTD-MT-24-2520-74) Avail: NTIS CSCL 20/12

The authors investigated the electrophysical properties of carbon fibers, obtained as a result of the pyrolysis of chemically modified cellulose and possessing cation-exchanging properties. The effect of the sulfonation of a carbon fiber on its electroconductivity was studied in connection with the fact that sulfonation increases the surface of the carbon fiber and, therefore, can affect the general electroconductivity of the fiber because of surface conductivity. On the other hand, the conductivity can increase because of the introduction of sulfogroups and carboxyls as ionogenic and electronegative groups. On the basis of these ion-exchanging fibers, materials containing metals - copper, nickel, sodium, cobalt are obtained by ion-exchanging sorption from aqueous solutions. The electroconductivity of these materials was studied both without further heat treatment and without the products of their pyrolysis at 700-900C in vacuum. GRA

N75-28935# Naval Postgraduate School, Monterey, Calif.
NARROW GAP SEMICONDUCTORS: PbSnTe AND PbSnSe Final Report, 1 Jan. 1972 - 30 Sep. 1973
Tien F. Tao Nov. 1974 52 p refs
(AF Proj. 7367)
(AD-A005702; NPS-52TV74-1; AFML-TR-74-162) Avail: NTIS CSCL 20/12

The following studies were carried out: Feasibility study of using MIS (metal-insulator-semiconductor) structures of 4-6 semiconductors as infrared charge coupled imagers; Study of the refractive index of PbSnTe; Studies of photoelectric effects in 4-6 alloy semiconductors; Study of the effects of proton bombardments and the isochronal annealings on PbTe and PbSnTe. GRA

N75-28842* Texas Instruments, Inc., Dallas.
EFFECTS OF IONIZING RADIATION ON CCD'S
G. A. Hartsell, D. A. Robinson, and D. R. Collins *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 216-227 refs (For availability see N75-28824 19-70)
(Contract F33615-74-C-1054)
CSCL 20L

N75-28843* Naval Research Lab., Washington, D.C.
EFFECTS OF IONIZING RADIATION ON CHARGE-COUPLED IMAGERS
J. M. Killiany, W. D. Baker, N. S. Saks, and D. F. Barbe *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 228-242 refs (For availability see N75-28824 19-70)
CSCL 20L

N75-28844* RCA Labs., Princeton, N.J.
EFFECTS OF RADIATION ON CHARGE-COUPLED DEVICES
James E. Carnes, A. Danforth Cope, Leonard R. Rockett, and Kenneth M. Schlesier *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 243-251 refs (For availability see N75-28824 19-70)
(Contract F19628-74-C-0039)
CSCL 20L

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer*.

N75-28936 Missouri Univ., Rolla.
TRANSITION BOILING OF NORMAL PENTANE FROM A HORIZONTAL FLAT GOLD SURFACE Ph.D. Thesis
Ronald Martin Canon 1974 60 p
Avail: Univ. Microfilms Order No. 75-15813

The characteristic boiling curve for normal pentane was determined at 1 atmosphere pressure with particular attention devoted to the transition boiling region. The heat transfer surface was a horizontal, gold plated, copper disc. Stability analysis was employed to demonstrate why previous investigators have had only limited success in collecting data in the transition region and to provide a valid basis for equipment designed to operate in this region. A method of predicting the transition region boiling curve from the nucleate curve and the Liedenfrost point is presented. The method was found to predict the transition boiling of normal pentane, Freon 12, Freon 113 and Freon 114.
Dissert. Abstr.

N75-28937 Missouri Univ., Rolla.
FILM BOILING OF FREON 113, NORMAL PENTANE, CYCLOPENTANE, AND BENZENE FROM CYLINDRICAL SURFACES AT MODERATE PRESSURES Ph.D. Thesis
Gary Joseph Capone 1973 142 p
Avail: Univ. Microfilms Order No. 75-15814

An investigation of film boiling heat transfer in saturated pools of liquid Freon 113, normal pentane, cyclopentane, and benzene was made. The fluids were boiled from copper, cylindrical heat transfer surfaces, 3 inches long, and 0.55, 0.75, and 1.00 inch in diameter. The heat transfer elements were positioned horizontally in an autoclave and tested at moderate pressures of up to a pressure of 242.5 psia for normal pentane. The experimental data are discussed and compared with known film boiling correlations. The known correlations were found to be inadequate in predicting heat transfer coefficients as a function of pressure, temperature difference between the heater surface and the fluid, surface diameter, and the type of fluid boiled. A correlation for film boiling is derived and discussed. The correlation was found to predict the film boiling of Freon 113, normal pentane, and benzene to within 10%. The correlation predicts the boiling behavior of cyclopentane to within 20%.
Dissert. Abstr.

N75-28938# Technische Hogeschool, Delft (Netherlands).
DEVELOPMENT OF A VERTICAL FLASH EVAPORATOR Ph.D. Thesis
Dick Gerrit Klaren 21 May 1975 268 p refs
Avail: NTIS HC $8.50

Various process cycles for the conventional horizontal flash evaporator are discussed along with the flow characteristics of vertical risers. Other topics discussed include the experimental determination of the process properties of a flash-down stage, mathematical modelling of vertical flash evaporator transients, and proposals for improving vertical flash evaporators. For individual titles, see N75-28939 through N75-28943.

N75-28939 Technische Hogeschool, Delft (Netherlands).
INTRODUCTION AND MOTIVATION
Dick Gerrit Klaren *In its* Development of a Vertical Flash Evaporator 21 May 1975 9 p refs (For availability see N75-28938 19-77)

Process cycles for the conventional horizontal flash evaporator are discussed, and the following possibilities for vertical flash evaporators are described: (1) the FLAP plant, where the brine flashes in a vertical upward direction only through risers; (2) the FLAUD plant, where over a number of stages at the high-temperature end of the plant the brine flashes upwards vertically through risers and over the remaining stages downwards vertically through orifices or slits; (3) the FLAD plant, where the brine flashes downwards vertically only through orifices of slits; and (4) the FLAD plant provided with a fluidized bed condenser. The vertical plants are compared with the conventional horizontal flash evaporators.
Author

N75-28940 Technische Hogeschool, Delft (Netherlands).
EXPERIMENTAL DETERMINATION OF THE FLOW CHARACTERISTICS IN RISERS
Dick Gerrit Klaren *In its* Development of a Vertical Flash Evaporator 21 May 1975 30 p refs (For availability see N75-28938 19-77)

Detailed information about the flow characteristics of flashing water or brine in cylindrical risers is presented. The construction and operation of the test module and the measuring techniques which were used for the experimental determination of these characteristics are discussed. The data presented should make it possible to evaluate the flashing process for application in vertical flash evaporators. Models concerning the calculation of flashing flow in risers, available from literature, are discussed. The experimental data obtained are compared with the computed results of one of these models.
Author

N75-28941 Technische Hogeschool, Delft (Netherlands).
EXPERIMENTAL DETERMINATION OF THE PROCESS PROPERTIES OF A FLASH-DOWN STAGE
Dick Gerrit Klaren *In its* Development of a Vertical Flash Evaporator 21 May 1975 17 p refs (For availability see N75-28938 19-77)

The experimental investigations into the process properties of a flash-down stage (mass flow, flash-off, and entrainment separation) were carried out in a test module which could be equipped for the transient experiments, which was also used for the investigation of the mass flow between two successive flash-down stages. A second column was built for the flash-off and entrainment separation experiments as the dimensions of the stages of the columns for the transient experiments were too large to obtain sufficiently high vapor space loadings.
Author

N75-28942 Technische Hogeschool, Delft (Netherlands).
MATHEMATICAL MODELLING VERTICAL FLASH EVAPORATOR TRANSIENTS
Dick Gerrit Klaren *In its* Development of a Vertical Flash Evaporator 21 May 1975 41 p refs (For availability see N75-28938 19-77)

To obtain an understanding of the time-dependent behavior of vertical flash evaporators, the transient process equations of a stage are derived. Because of the reduced flash chamber dimensions of vertical plants, it is shown that stable operation in a vertical plant is easier to disturb due to the variation of the heat input into the brine heater and the temperature variation of the entering cold feed. Experiments carried out on a 3-stage test module containing flash-down stages only, make it possible to compare the calculated transients with the data obtained experimentally; the agreement is considered fair.
Author

N75-28943 Technische Hogeschool, Delft (Netherlands).
PROPOSAL FOR AN IMPROVED VERTICAL FLASH EVAPORATOR
Dick Gerrit Klaren *In its* Development of a Vertical Flash Evaporator 21 May 1975 50 p refs (For availability see N75-28938 19-77)

From a detailed investigation into the possibilities of a fluidized bed heat exchanger (FBE) combined with the FLAD-plant, it is concluded that the FBE yields a cost reduction of the distillate produced, in comparison with the conventional horizontal flash evaporator. If applying a high gain-ratio FBE and considering the sharp rise of the fuel cost over the last few years, savings may run as high as 25%; this can be further increased by plant optimization and by making use of the scale removing capacity of the fluidized bed heat exchanger. The characteristics of the fluidized bed heat exchanger are discussed in detail. Author

N75-28944# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
TURBULENT NATURAL CONVECTION OF LIQUID DEUTERIUM, HYDROGEN, AND NITROGEN WITHIN ENCLOSED VESSELS Final Report
David E. Daney Feb. 1975 83 p refs Sponsored in part by ERDA
(COM-75-10396/0; NBSIR-75-807) Avail: NTIS HC $4.75 CSCL 20M

Quasi-steady natural convection of liquid deuterium, hydrogen, and nitrogen within a sphere, hemisphere, horizontal cylinder, and vertical cylinder was studied experimentally for the case of a nearly isothermal wall. A single expression relating the Nusselt and Rayleigh numbers, fits the deuterium and nitrogen data, while the hydrogen Nusselt numbers are 8 percent lower. The temperature field within the vessels is virtually free of horizontal temperature gradients. A single dimensionless temperature profile characterizes the vertical temperature distribution for each vessel shape, with the profiles for the sphere, hemisphere, and horizontal cylinder being nearly identical. GRA

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N75-28945*# Stanford Univ., Calif. School of Engineering.
ENGINEERING EDUCATION AND A LIFETIME OF LEARNING
Joe Eisley, ed. 30 Aug. 1974 228 p refs
(Grant NGR-05-020-409)
(NASA-CR-143253) Avail: NTIS HC $7.50 CSCL 05I

The result of an eleven-week study by the National Aeronautics and Space Administration (NASA) and the American Society of Engineering Education is presented. The study was the ninth of a series of programs. The purposes of the programs were: (1) to introduce engineering school faculty members to system design and to a particular approach to teaching system design, (2) to introduce engineering faculty to NASA and to a specific NASA center, and (3) to produce a study of use to NASA and to the participants. The story was concerned with engineering education in the U.S., and concentrated upon undergraduate education and teaching, although this bias was not meant to imply that research and graduate study are less important to engineering education. Author

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N75-28946# Technische Hogeschool, Eindhoven (Netherlands).
ON PROBLEM SOLVING IN TECHNICAL DOMAIN Ph.D. Thesis
Derk Willem Vaags [1974] 240 p refs In DUTCH; ENGLISH summary
Avail: NTIS HC $7.50

Various methods of learning employed to solve problems in mechanical engineering are presented. Results indicate that video recording and playback to students is the most effective instruction process. A comparison of analytical thinking to rote memory was made, and variables which affect learning, such as personality, are discussed. J.R.T.

N75-28947# Office of Naval Research, Arlington, Va.
MANAGEMENT STUDIES AND THEIR IMPACT ON NAVAL RESEARCH
Robert J. Mindak 1 Nov. 1974 197 p refs
(AD-A005420; ONR-ACR-205) Avail: NTIS CSCL 05/2

A brief review of 18 management studies on naval research and development in science, along with the Government Procurement Report of 1972 is presented. Conclusions and recommendations are summarized. J.R.T.

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information storage and retrieval technology; micrography; and library science.

For computer documentation see *61 Computer Programming and Software*.

N75-28948 Texas A&M Univ., College Station.
ON THE DEVELOPMENT OF AN INTERACTIVE RESOURCE INFORMATION MANAGEMENT SYSTEM FOR ANALYSIS AND DISPLAY OF SPATIOTEMPORAL DATA Ph.D. Thesis
John August Schell 1974 273 p
Avail: Univ. Microfilms Order No. 75-15064

Computer programming for earth imagery from the Earth Resources Technology Satellites is presented. Formal language definitions and syntax interpretation algorithms were adapted to provide a flexible, computer information system for the maintenance of resource interpretation of imagery. These techniques were incorporated, together with image analysis functions, into an interactive resource information management and analysis system, which was augmented with a dynamic color display for image presentation. Dissert. Abstr.

N75-28949 Maryland Univ., College Park.
OPTIMAL SEARCH TRAJECTORIES Ph.D. Thesis
David Victor Kalbaugh 1974 116 p
Avail: Univ. Microfilms Order No. 75-14304

The rational methods for the design of search trajectories are presented. Target motion and the act of detection were modeled as Markov processes, and the essence of the search was embodied in a modification of the Kolmogorovs partial, differential equation. Optimization techniques were applied to this equation to develop supporting computational methods. A set of necessary conditions for the optimal control was derived: a minimum principle in the form of a two-point boundary value problem in both ordinary and partial differential equations. A numerical algorithm that uses the necessary conditions as a guide to iteratively improve a supplied initial trajectory was devised. The algorithm is shown to improve the probability of finding the target on each iteration. Ten numerical examples were studied. Dissert. Abstr.

N75-28950 Texas A&M Univ., College Station.
A GENERAL MODEL FOR STORAGE AND RETRIEVAL OF CHEMICAL STRUCTURES Ph.D. Thesis
Jose Villarreal, Jr. 1974 230 p
Avail: Univ. Microfilms Order No. 75-15079

A generalized model for storage and retrieval was designed, developed, and implemented. It was adapted to a crystallographic chemical data base. The thesis is that it is possible to design general systems in a modular fashion such that particular modules can be tailored to meet peculiar input/output requirements in certain applications. The system developed as a result of this project can be classified as general since it possesses a certain degree of hardware-independence, data-independence, and applications-independence. The system might also be characterized as pseudo-general since certain modules, input/output related,

that make up the system have to be tailored to fit a particular application's requirements. The major portion of the system remains independent of the input data and output requirements. The system permits four methods of retrieval which include facilities for accession number, browsing, and keyword retrievals. It also has a screen searching retrieval capability. Dissert. Abstr.

N75-28951 Pennsylvania Univ., Philadelphia.
A FRAMEWORK OF STANDARDS FOR INFORMATION SYSTEM DESIGN AND IMPLEMENTATION Ph.D. Thesis
David Michael Sherr 1974 451 p
Avail: Univ. Microfilms Order No. 75-14623

A conceptual framework to serve as a basis for developing a practical set of specification standards for information systems (IS), including a methodology for their application is presented. The topics considered: are (1) the development of a methodology for separating the design and implementation functions, levels of specification, and roles which perform the functions; and (2) the development of a framework including the conceptualization of a process for IS development, the definition of the roles involved in design and implementation, and the communications requirements among the roles. A set of IS Specification Standards which support communications between the activities of IS design and IS program implementation, and which facilitate the separation of these two activities is also presented. Dissert. Abstr.

N75-28952 Pennsylvania Univ., Philadelphia.
TOS: A TEST ORGANIZING SYSTEM Ph.D. Thesis
Kemal Koeymen 1974 472 p
Avail: Univ. Microfilms Order No. 75-2748

The research is reported which was undertaken to conceptualize, design and implement a system for automatic indexing, classification and repositing of text items, which may be any aggregates of information in English on a computer-readable media in a standard format. The ultimate goal is to devise all automatic processes which would read text items, and then index, classify and reposit them for subsequent search and retrieval. Only portions of the path to this goal have been made fully automatic. These portions consist of all automatic processes as follows: 1. Analyzing the text items and assigning candidate index terms to the items. 2. Generating and assigning candidate index phrases to the items. 3. Discriminating and rejecting candidate index terms determined to be ineffective automatically. 4. Generating a classification system and repositing the text items in accordance with this system. Dissert. Abstr.

N75-28953 Illinois Univ., Urbana.
SPEEDUP OF ITERATIVE PROGRAMS IN MULTIPROCESSING SYSTEMS Ph.D. Thesis
Shyh-Ching Chen 1975 135 p
Avail: Univ. Microfilms Order No. 75-14094

Algorithms to expose vector operations and recurrence relations which constitute a loop computation and, in turn transfer recurrence relations into vector operations are presented. For the latter case, time and processor bounds for different classes of problems and practical situation are discussed. Bounds on speedups of different types of loop computations are given for machine designers or users. Dissert. Abstr.

N75-28954# Committee on Labor and Public Welfare (U. S. Senate).
FEDERAL MANAGEMENT OF SCIENTIFIC AND TECHNICAL INFORMATION (STINFO) ACTIVITIES: THE ROLE OF THE NATIONAL SCIENCE FOUNDATION
Robert L. Chartrand and Rosemary A. Chalk Washington GPO Jul. 1975 123 p refs Rept. prepared for Special Subcomm. on the Natl. Sci. Foundation of Comm. on Labor and Public Welfare, 94th Congr., 1st Sess., Jul. 1975 Prepared by the Library of Congr., Sci. Policy Res. Div.
(GPO-54-874) Avail: Comm. on Labor and Public Welfare

The role of the Federal Government, and in particular the National Science Foundation, in managing and monitoring scientific and technical information (STINFO) activities in both the public and private sectors is examined. An overview of the conceptual and factual information essential to an understanding of STINFO activities is given, including a review of salient developments during the preceding two decades. A retrospective look at the full range of studies, policy-level decisions, and organizational actions affecting the evolution of the STINFO community in the period 1950-1975 is presented. The role of Congress in this area is discussed. Author

N75-28955# Princeton Univ., N.J. Dept. of Aerospace and Mechanical Sciences.
ON THE OPTIMAL UTILIZATION OF EXPERIMENTAL DATA
Frediano V. Bracco 12 Jun. 1975 37 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Nov. 1975
Avail: NTIS HC $3.75

The inverse method comprised of determining some variables experimentally and in using them in equations to compute other variables is analyzed. When generalized, this method becomes a procedure to obtain maximum information out of a set of experimental data. It is considered a method of investigating physical problems which combines the advantages, and limits the disadvantages, of solely experimental or theoretical approaches. The logic of the method is outlined and its properties are listed. Introductory, complete, and incomplete examples are included from the field of reactive fluid dynamics. Author

N75-28956*# Technicolor Graphic Services, Inc., Houston, Tex.
FILM HANDLING PROCEDURES FOR APOLLO 17 LUNAR SOUNDER
Mark S. Weinstein 8 Nov. 1972 29 p refs
(Contract NAS9-11500)
(NASA-CR-141922; JL12-201) Avail: NTIS HC $3.75 CSCL 05B

Film handling procedures for the Apollo 17 Lunar Sounder are itemized, including purchase of flight film, establishment of processing standards, transportation of flight films, flight film certification, application of pre- and post-sensitometry, film loading and downloading, film processing, titling, and duplication.
Author

N75-28957*# Technicolor Graphic Services, Inc., Houston, Tex.
FILM HANDLING PROCEDURES FOR SKYLAB S-056 EXPERIMENT
Paul F. Bourque 1 Mar. 1973 12 p
(Contract NAS9-11500)
(NASA-CR-141920; JL12-204) Avail: NTIS HC $3.25 CSCL 05B

Procedures for handling, and flight film acceptance testing through original film processing to the duplication of the original film, are presented. Author

N75-28958# Defense Documentation Center, Alexandria, Va.
STATE-OF-THE-ART REVIEWS Report Bibliography, Feb. 1947 - May 1974
Feb. 1975 283 p refs
(AD-A005375; DDC-TAS-74-41) Avail: NTIS CSCL 05/2

This bibliography contains 229 references pertinent to the evaluation and results of surveys, studies, and literature searches in the state-of-the-art reviews of selected subjects. The Indexes included are Corporate Author-Monitoring Agency and Subject.
GRA

N75-28959# Committee on Information Hang-Ups, Washington, D.C.
ESPECIALLY DDC. USERS LOOK AT THE DoD INFORMATION TRANSFER PROCESS
Jan. 1975 85 p
(AD-A005400) Avail: NTIS CSCL 05/2

The Committee on Information Hang-ups examines DDC's services to information users and looks at some aspects of the information transfer process within the Department of Defense. While minor aspects of DDC's operations are criticized, users feel that no major changes are required, although greater efforts need to be made to educate users in what DDC offers. Serious obstacles to the information transfer process within DoD were identified. A substantial part of the difficulties found in transferring information arises because there is no coordination of the process among divisions of the Executive branch of the government. Users should take an active part in developing a climate of opinion favorable to establishing such coordination.
GRA

N75-28960# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
TECHNICAL PUBLICATIONS AND PRESENTATIONS, CALENDAR YEAR 1972
1972 23 p refs
(AD-A005323; ARL-MR-73-0001) Avail: NTIS CSCL 05/2

The report contains a listing of publications and presentations authored or co-authored by civilian and military scientists/engineers of the Aerospace Research Laboratories. Efforts listed were generated under ten ARL laboratories which include: Applied mathematics; Energy conversion; Fluid dynamics; General physics; Hypersonics; Chemistry; Metallurgy and Ceramics; Solid state physics; Plasma physics; and Thermomechanics.
GRA

N75-28961# Air Force Materials Lab., Wright-Patterson AFB, Ohio.
AIR FORCE TECHNICAL OBJECTIVE DOCUMENT, FISCAL YEAR 1975
Oct. 1974 28 p
(AD-A005386; AFML-TR-74-270) Avail: NTIS CSCL 05/2

This Technical Objective Document was prepared by the Air Force Materials Laboratory (AFML) and describes the Materials Technology Areas for meeting future Air Force operational needs. The six Technology Areas encompass the full spectrum of materials capabilities required for future aircraft, missile, space, and electronic systems - Thermal Protection Materials; Aerospace Structural Materials; Aerospace Propulsion Materials; Fluid, Lubricant, and Elastomeric Materials; Protective Coatings and Materials; and Electromagnetic Materials. Presented for each TA is the general objective, specific goals, technical approaches, and a Laboratory TA focal point who can facilitate face-to-face discussions with Laboratory engineers and scientists. GRA

N75-28962# Informatics, Inc., Rockville, Md.
INFORMATION SUPPORT FROM FOREIGN SCIENTIFIC LITERATURE Quarterly Technical Report, Oct. - Dec. 1974
Stuart G. Hibben 24 Jan. 1975 6 p
(Contract N00600-75-C-0018; DARPA Order 2790)
(AD-A004994) Avail: NTIS CSCL 05/2

Abstracting of current Soviet material was continued on the topics of laser technology, oceanography, seismology, energy conversion, and climatology. Collection of recent material on radioactive radiation detection was completed, and a survey report on surface effect vehicles is nearing completion. A retroactive search on selected Soviet authors and institutes was completed.
GRA

N75-28963# Michigan Univ., Ann Arbor. Dept. of Industrial and Operations Engineering.
EVALUATION AND OPTIMIZATION OF FILE ORGANIZATIONS THROUGH ANALYTIC MODELING Ph.D. Thesis
Shi Bing Yao 1974 222 p refs
(Contract AF-AFOSR-2219-72; AF Proj. 9769)
(AD-A005721; AFOSR-75-0275TR) Avail: NTIS CSCL 05/2

The research concerns the selection of appropriate file structures and access methods for the construction of large data bases within information systems. A file design system is developed here that can be used by a file designer to select good file organizations from a large number of alternatives. This design system takes its design requirement parameters from the data collection, user activities, and machine characteristics. The output of the design system is a suggested file structure, and the details of the actual file structure can be determined by simulation or other techniques.
GRA

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N75-28964# National Planning Association, Washington, D.C.
DEMAND FOR SCIENTIFIC AND TECHNICAL MANPOWER IN ENERGY-RELATED INDUSTRIES: UNITED STATES 1970-1985 Final report
Ivars Gutmanis, Rita A. McBrayer, Richard P. Mckenna, and Richard Kotz Oct. 1974 249 p refs
(Grant NSF GR-32464)
(PB-240865) Avail: NTIS HC $7.50 CSCL 05I

Requirements for scientists and engineers in the domestic projection of energy in 1985 are reported. Estimates are included only for the following selected industries: electric power generation, transmission and distribution, petroleum and natural gas extraction, and petroleum refining, natural gas production, transmission, and distribution, coal mining; nuclear power production and radioactive waste disposal; manufacture of selected producers durable equipment for electric companies; and energy-related construction.
GRA

N75-28965# Kentucky Legislative Research Commission, Frankfort.
THE KENTUCKY ENVIRONMENTAL AND ECONOMIC DEVELOPMENT POLICY PROJECT Interim Report, 1 Jul. 1973 - 31 Jul. 1974
5 Aug. 1974 56 p
(Grant NSF GT-39330)
(PB-240766/6; NSF/RA/G-74-010) Avail: NTIS HC $4.25 CSCL 13B

A project is described which prepares legislation that embodies a Kentucky Environmental and Economic Development Policy and establishes mechanisms that bring to bear the institutions, resources, and procedures necessary for its implementation.
GRA

N75-28966# Cooper and Co., Stanford, Conn.
EVALUATION OF METHODOLOGY FOR ESTIMATING THE COST OF AIR FORCE ON-THE-JOB TRAINING Final Report, Oct. 1973 - Jun. 1974
Bernard N. Samers, Alan D. Dunham, and Fred Nordhauser Nov. 1974 50 p refs
(Contract F41609-72-C-0048; AF Proj. 2077)
(AD-A005298; AFHRL-TR-74-73) Avail: NTIS CSCL 05/9

The report describes the final phase of a study directed at the development of an on-the-job training (OJT) costing methodology. Utilizing a modification of survey techniques tested and evaluated during the previous phase, estimates were obtained for the cost of OJT for airman training from the 1-level (unskilled) to the 3-level (semi-skilled) in five category B Air Force specialties. The specialties studied were pavement maintenance (551X0); fire protection (571X0); food service (622X0); fuel service (631X0); and material facilities (647X0). The cost per graduate of OJT for these specialties was compared to the cost per graduate of resident school technical training. Supervisors were surveyed to determine if there was a difference in performance between OJT and technical school graduates in these AFSCs. Conditional cost models were also formulated and tested. The conditional cost models are based on an alternative or opportunity cost concept and represent a refinement of the original cost models.
GRA

84 LAW AND POLITICAL SCIENCE

Includes space law; international law; international cooperation; and patent policy.

No abstracts in this category.

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see *03 Air Transportation and Safety*, *16 Space Transportation*, and *44 Energy Production and Conversion*.

N75-28967 Texas Univ., Arlington.
APPLICATION OF FAST SPARSE-MATRIX TECHNIQUES AND AN ENERGY ESTIMATION MODEL FOR LARGE TRANSPORATION NETWORKS Ph.D. Thesis
Howard Alanson Smolleck 1975 280 p
Avail: Univ. Microfilms Order No. 75-14488

A near-optimal path assignment problem and the development of a model for rapidly estimating the total amount of energy consumed daily by automotive vehicles operating within a large metropolitan area is presented. The development of electric circuit models for large transportation networks and their applications was studied. An algorithm for network alterations and peculiarities was investigated, and computational techniques for checking and correcting ill-conditioned highway network data were developed. A method for subdividing the highway network into primary and secondary subsystems, in a manner analogous to that used in the solution of electric power-flow problems, was formulated in order to increase solution speed and accuracy. A model for estimating the total vehicular energy consumption within a highway network based upon path assignments is shown.
Dissert. Abstr.

N75-28968*# Denver Univ., Colo.
FIRE SAFETY: A CASE STUDY OF TECHNOLOGY TRANSFER
Conrad F. Heins Washington NASA Aug. 1975 38 p refs (Contract NASw-2607)
(NASA-CR-2594) Avail: NTIS HC $3.75 CSCL 13L

Two basic ways in which NASA-generated technology is being used by the fire safety community are described. First, improved products and systems that embody NASA technical advances are entering the marketplace. Second, NASA test data and technical information related to fire safety are being used by persons concerned with reducing the hazards of fire through improved design information and standards. The development of commercial fire safety products and systems typically requires adaptation and integration of aerospace technologies that may not have been originated for NASA fire safety applications.
Author

N75-28969# National Bureau of Standards, Washington, D.C. Technical Analysis Div.
POINT-TO-POINT TRIP MANAGEMENT PROGRAM (PRELIMINARY ANALYSIS) Final Report
William G. Kienstra and Daniel J. Minnick 7 Feb. 1975 27 p refs Sponsored in part by DOT
(COM-75-10421/6; NBSIR-75-665) Avail: NTIS HC $3.75 CSCL 13B

The preliminary analysis of Point-To-Point Trip Management (PTPTM) is concerned with providing prospective riders of mass transit with the necessary detailed information for particular trips. This report contains the results of a literature search on automation in the telephone information center, and analyzes the data collected from 29 existing centers. Additionally, on-site visits were made to three operational centers, and tapes of actual telephone inquiries and responses were obtained and analyzed. The use of microfiche and computers are examined as an aid to the operators in these centers. Total automation of these centers is also discussed.
GRA

88 SPACE SCIENCES (GENERAL)

N75-28970# Committee on Appropriations (U. S. Senate).
DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT, AND CERTAIN INDEPENDENT AGENCIES APPROPRIATIONS FOR FISCAL YEAR 1976. PART 2: CONSUMER PRODUCTS SAFETY COMMISSION, ENVIRONMENTAL PROTECTION AGENCY, GENERAL SERVICES ADMINISTRATION, NONDEPARTMENTAL WITNESSES, OFFICE OF CONSUMER AFFAIRS, SELECTIVE SERVICE SYSTEM
Washington GPO 1975 981 p refs Hearings on H.R. 8070 before a subcomm. of Comm. on Appropriations, 94th Congr., 1st Sess., 28 Apr. 1975
(GPO-49-271) Avail: Comm. on Appropriations

A comprehensive evaluation of budgetary needs for various Federal programs is presented. Topics discussed are: (1) environment pollution i.e., a model study of the factors contributing to pollution in the Chesapeake Bay; (2) education, specifically science education grants to universities and colleges; (3) consumer product safety (the regulation of toys on the market); and (4) housing subsidies and community development.
J.R.T.

89 ASTRONOMY

Includes radio and gamma-ray astronomy; celestial mechanics; and astrometry.

N75-28971 California Univ., Davis.
NUMERICAL STUDIES OF MASS TRANSFER AND ACCRETION IN X-RAY BINARY SYSTEMS Ph.D. Thesis
Marvin Leonard Alme 1974 198 p
Avail: Univ. Microfilms Order No. 75-15418

Several aspects of mass transfer and accretion in X-ray binary systems were investigated numerically. Computer calculations were performed on (1) the X-ray emission resulting from the accretion of material onto a neutron star, (2) the X-ray heating of the surface of HZ Her, and (3) the X-ray heating of a gas stream leaving HZ Her through the inner Lagrangian point, falling toward Her X-1. In accretion calculations it was found that for high mass neutron stars, the emitted spectra differ only slightly from blackbody, particularly at low luminosities. For intermediate mass neutron stars the spectra differ substantially from blackbody spectra, especially at higher luminosities. The calculated spectra differ greatly from blackbody spectra at all luminosities for low mass neutron stars. The attenuation and diffusion of a beam of X-rays incident on the surface of HZ Her were calculated. Atmospheric hydrogen is assumed to be in LTE. All other elements are treated non-LTE. Compton scattering and energy exchange are included. These time dependent calculations incorporate hydrodynamics with radiation pressure.
Dissert. Abstr.

N75-28972 City Univ. of New York.
DIELECTRIC PROPERTIES OF THE MAGNETIC SURFACE OF NEUTRON STARS Ph.D. Thesis
Joseph Ventura 1975 180 p
Avail: Univ. Microfilms Order No. 75-13643

By using the quantum theory, explicit expressions for a dielectric tensor, which governs the propagation of electromagnetic waves were obtained. Deviations from the magnetoionic theory were carefully explored in the long wavelength approximation. A numerical study for a 'one dimensional' electron gas, where only the ground state Landau level was occupied, is shown. The effect of collisions in the magnetic surface was studied. It is shown that the geometry of a scattering event is drastically affected by the presence of the magnetic field. Explicit and general expressions were obtained for the scattering cross-section and collision frequency in the magnetic field. A reduction of the effective collision frequency with increasing magnetic field strength was found.
Dissert. Abstr.

N75-28973 Arizona Univ., Tucson.
THE EMISSION FROM PULSARS. 1: A GENERALIZED SINGLE-VECTOR POLARIZATION MODEL. 2: A MODEL FOR THE SUB-PULSE AND INTEGRATED PULSE BEHAVIOR Ph.D. Thesis
Dale Curtis Ferguson 1974 332 p
Avail: Univ. Microfilms Order No. 75-14216

The properties of models for pulsar polarization which incorporate localized emission regions corotating with a neutron star were investigated. The formulae applicable to the case where emission comes from near the neutron star surface are derived and compared with those applicable for emission from further out in the magnetosphere. In all the models investigated, it is assumed that the instantaneous polarization position angle is given by the apparent projection of a corotating magnetic field vector on the plane of the sky, and that the percentage of linear polarization is proportional to some power of the apparent projected length of the vector along the line of sight. Relativistic effects which become important for emission from far out in

the magnetosphere are discussed and related to the polarization behavior predicted by the models. The pulsar observations important for an understanding of their physical nature are discussed. The relativistic vector model is fit to several pulsars which represent different classes in a popular classification scheme. The Crab Nebula pulsar is discussed in detail.
Dissert. Abstr.

N75-28974# Instituto y Observatorio Astronomico de Marina, San Fernando (Spain).
AERONAUTICAL ALMANAC FOR MAY TO AUGUST 1975
1975 312 p In SPANISH
Avail: NTIS HC $9.25

Data tabulated on the position of the planets, the sun, the stars and the moon, for the summer months of the year, as an aid to navigation, are presented. J.R.T.

N75-28975*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SEARCH FOR X-RAYS FROM UV CETI FLARE STARS
Carol Jo Crannell, Thomas H. Markert (MIT), Thomas J. Moffett (Tex. Univ., Austin), and Steven R. Spangler (Iowa Univ.) Jun. 1975 4 p refs Presented at 14th Intern. Cosmic Ray Conf., Munich, 15-29 Aug. 1975
(NASA-TM-X-70918; X-682-75-139; Paper-OG-4-6) Avail: NTIS HC $3.25 CSCL 03A

A search of MIT/OSO-7 data was made for evidence of X-ray emission from flares of UV Ceti flare stars. Observations from McDonald Observatory were used to identify the times of optical flares. The only instance of coincident coverage occurred on 1974 January 21 UT at 03:43:26 GMT for delta m(u) = 0.86 flare of YZ CMi. No radio coverage of this particular event was obtained. Upper limits (3 sigma) of 0.8, 1.0, and 0.7 photons/sq cm-sec on the observed X-ray flux were set for the energy ranges greater than or approximately equal to 15, greater than or approximately equal to 3, and 1-10 keV, respectively. Author

N75-28976# Owens Valley Radio Observatory, Pasadena, Calif.
TIME DEPENDENCE OF THE INTEGRATED STOKES PARAMETERS OF COMPACT RADIO SOURCES AT 5 GHz
G. A. Seielstad and G. L. Berge 1975 47 p refs Sponsored by ONR
(AD-A005409; Rept-1975-4) Avail: NTIS CSCL 03/2

The integrated 5 GHz radio emission, including the complete polarization state as well as the flux density, of 15 compact radio sources was monitored for a period of 27 months. In the data presented, there are several examples of interesting time variations. However, the diverse behavior and other properties of the sources defy any satisfactory generalizations regarding mechanisms. GRA

90 ASTROPHYSICS

Includes cosmology; and interstellar and interplanetary gases and dust.

N75-28977 Wisconsin Univ., Madison.
CORONAS WITH BREMSSTRAHLUNG COOLING Ph.D. Thesis
Nelson Miles Hoffman, III 1974 92 p
Avail: Univ. Microfilms Order No. 75-9977

The structure and observable properties were studied of a corona which is sufficiently hot and dense that radiative cooling is a significant contributor to the energy balance. Accordingly the hydrodynamic equations for a stationary, spherically-symmetric inviscid one-fluid optically-thin stellar wind, heated by electron conduction and cooled by bremsstrahlung, are presented and solved. It is found that at sufficiently large absolute values of the gravitational potential, a region appears in which the conductive heating rate and the bremsstrahlung cooling rate are nearly in equilibrium. Analytic approximations to the solutions in this region are found, and are used to justify some of the simplifying assumptions incorporated in the model. Approximate analytic solutions are found for all other regions of the flow as well. Finally, the applicability of these models to the hypothetical coronas of white dwarfs is discussed. Dissert. Abstr.

N75-28978*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE LIGHT CURVE OF A TRANSIENT X-RAY SOURCE
Louis J. Kaluzienski (Maryland Univ., College Park), S. S. Holt, E. A. Boldt, P. J. Serlemitsos, G. Eadie (Leicester Univ.), K. A. Pounds (Leicester Univ.), M. J. Ricketts (Leicester Univ.), and M. Watson (Leicester Univ.) Jul. 1975 14 p refs Submitted for publication
(NASA-TM-X-70938; X-661-75-178) Avail: NTIS HC $3.25 CSCL 03B

The Ariel-V satellite monitored the X-ray light curve of A1524-62 almost continuously from 40 days prior to maximum light until its disappearance below the effective experimental sensitivity. The source exhibited maximum light on approximately 4 December 1974, at a level of 0.9 the apparent magnitude of the Crab Nebula in the energy band 3-6 keV. Although similar to previously reported transient sources with a decay time constant of approximately 2 months, the source exhibited an extended, variable pre-flare on-state of about 1 month at a level of greater than approximately 0.1 maximum light. The four bright (greater than 0.2 of the Crab Nebula) transient sources observed during the first half-year of Ariel-V operation are indicative of a galactic disk distribution, and a luminosity at maximum in excess of 10 to the 37th power ergs/sec. Author

N75-28979*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
NET FIELD-ALIGNED CURRENTS OBSERVED BY TRIAD
Masahisa Sugiura and Thomas A. Potemra (Johns Hopkins Univ., Laurel, Md.) Jul. 1975 35 p refs Submitted for publication
(NASA-TM-X-70939; X-625-75-180) Avail: NTIS HC $3.75 CSCL 03B

From the Triad magnetometer observation of a step-like level shift in the east-west component of the magnetic field at 800 km altitude, the existence of a net current flowing into or away from the ionosphere in a current layer was inferred. The current direction is toward the ionosphere on the morning side and away from it on the afternoon side. The field aligned currents observed by Triad are considered as being an important element in the electro-dynamical coupling between the distant magnetosphere and the ionosphere. The current density integrated over the thickness of the layer increases with increasing magnetic activity, but the relation between the current density and Kp in individual cases is not a simple linear relation. An extrapolation of the statistical relation to Kp = 0 indicates existence of a sheet current of order 0.1 amp/m even at extremely quiet times. During periods of higher magnetic activity an integrated current of approximately 1 amp/m and average current density of order 0.000001 amp/sq m are observed. The location and the latitudinal width of the field aligned current layer carrying the net current very roughly agree with those of the region of high electron intensities in the trapping boundary. Author

N75-28980*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
WINTER BULGE AND DIURNAL VARIATIONS IN HYDROGEN INFERRED FROM AE-C COMPOSITION MEASUREMENTS
H. C. Brinton, H. G. Mayr, and W. E. Potter Jun. 1975 19 p refs Submitted for publication
(NASA-TM-X-70932; X-621-75-149) Avail: NTIS HC $3.25 CSCL 03B

The atomic hydrogen distribution at 250 km during December 1974 solstice was inferred, considering charge exchange equilibrium, from Atmosphere Explorer-C measurements of n(H(+)), n(O(+) and N(O). An empirical model, derived from the observations by least suqare analysis in terms of spherical harmonics, has the following characteristics: (1) n(H) increases by as much as a factor of two between the summer and winter hemispheres, (2) the n(H) diurnal variation is largest at the equator and (3) the diurnal variation is larger in the winter hemisphere than in the summer. Similar analysis of the gas temperature derived from n(N2) measurements reveals that all n(H) and Tg spherical harmonic coefficients are anticorrelated. Both the diurnal and latitudinal (annual) n(H) and Tg amplitudes are in substantial

agreement with the zero flux condition, in which exospheric flow dominates the hydrogen distribution. The observed diurnal phase lag of n(H) with respect to Tg is about one hour, agreeing with theory. Author

N75-28981*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A STUDY OF ELECTRON DENSITY PROFILES IN RELATION TO IONIZATION SOURCES AND GROUND-BASED RADIO WAVE ABSORPTION MEASUREMENTS, PART 2
S. Gnanalingam and J. A. Kane May 1975 22 p refs
(NASA-TM-X-70931; X-623-75-145-Pt-2) Avail: NTIS HC $3.25 CSCL 03B

The D-region ion production functions are used to calculate the relationship between radio wave absorption and the flux level of X-rays in the 1-8A wavelength band. In order to bring this calculation into agreement with the empirically established relationship, it was found necessary to reduce by, a factor of about 5, the Meira nitric oxide densities below 90 km. Author

N75-28982# Owens Valley Radio Observatory, Pasadena, Calif.
OH ZEEMAN OBSERVATIONS OF INTERSTELLAR DUST CLOUDS
Richard M. Crutcher, N. J. Evans, II, Tom Troland, and Carl Heiles 1975 9 p refs
(Contract N00014-67-A-0094-0019; Grant NSF GP-30400)
(AD-A005570; Rept-1975-2) Avail: NTIS CSCL 03/2

Zeeman splitting of OH emission lines in two dust clouds was measured. The upper limits on the Zeeman splitting indicate that the large scale magnetic fields are less than 50 microgauss, a value significantly less than that expected if the magnetic field is frozen in during collapse. GRA

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights.

For spacecraft design see *18 Spacecraft Design Testing, and Performance*. For space stations see *15 Launch Vehicles and Space Vehicles*.

N75-28983 California Univ., Davis.
A NUMERICAL STUDY OF THE PLANETARY BOUNDARY LAYER WITH AN ANALYSIS OF PARAMETER SENSITIVITY Ph.D. Thesis
Timothy James Peterson 1974 196 p
Avail: Univ. Microfilms Order No. 75-15449

The planetary boundary layer was studied through the introduction of a new parameter sensitivity analysis technique and the construction of a line source transport model. The planetary boundary layer equations were numerically integrated using an implicit finite difference routine. By assuming an exchange coefficient relationship the closure problem was satisfied. The sensitivity analysis technique is new for fluid mechanics type problems. This analysis technique was applied to both the planetary boundary layer equations and a global energy transport equation. All important parameters in the planetary boundary layer equations were investigated for their influence on the equations, for a variety of assumed atmospheric conditions. The transport model was applied to the specific case of the dispersion of carbon monoxide gas away from a highway. Dissert. Abstr.

N75-28984 Texas A&M Univ., College Station.
RADIATIVE TRANSFER IN THE ATMOSPHERES OF VENUS AND THE EARTH Ph.D. Thesis
Charles Nathan Adams 1974 136 p
Avail: Univ. Microfilms Order No. 75-15007

The flux and polarization reflected from a spherically symmetric planetary atmosphere is calculated by the Monte Carlo technique. Spherical geometry is used throughout the calculation with no plane-parallel approximations. The scattering angle for the photons is chosen from an appropriate single-scattering function calculated from Mie theory. The photons are followed through all orders of multiple scattering. Models considered for the Venus atmosphere include several single-layered models with various particle size distributions and one multilayered model. The results, when compared with experimental observations, suggest that the clouds are composed of particles having a mean radius of the order of 1 micron and a refractive index in the range from 1.45-1.6. Differences between theory and experiment may result from aspherical particles and a variation of the composition and size distribution of the particles with height in the atmosphere. Dissert. Abstr.

N75-28985*# National Aeronautics and Space Administration, Washington, D.C.
SUMMARY OF THE PROCEEDINGS OF THE MARS SURFACE SAMPLE RETURN SYMPOSIUM
D. L. DeVincenzi and R. D. MacElroy 25 Oct. 1973 20 p Symp. held at Moffett Field, Calif., 24-25 Oct. 1973
(NASA-TM-X-72442) Avail: NTIS HC $3.25 CSCL 03B

A summary is made of various technical and scientific aspects of a Mars surface sample return mission. Particular attention was focused on the question of back contamination. Data are also given on problems inherent in the back contamination issue and return sample mission; areas where additional research is needed were pointed out. Quarantine procedures, safety measures, and sterilization effects on organic-inorganic data, and biological problems were also dealt with. Author

N75-28986*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ON THE REALITY OF THE VENUS WINDS
John E. Ainsworth and J. R. Herman Jun. 1975 9 p refs
(NASA-TM-X-70930; X-623-75-147) Avail: NTIS HC $3.25 CSCL 03B

The Venera measurements of wind speed along with the Mariner measurements of lower-region of strong turbulence are evidence for a wide band of variable high speed retrograde horizontal winds which girdle Venus at the equator. In one interpretation of the Mariner 10 UV photographs, the 20km region above the top of the visible cloud is characterized by variable high-speed retrograde horizontal winds which orbit Venus with an average period of 4 earth days, and by many features indicating vertical convection. This suggests that the Venera-Mariner band of winds at 45km extends to the top of the UV cloud and beyond, and that the upper-region of strong turbulence detected by the Mariners may result from vertical convection currents carried along by high speed horizontal winds. In another interpretation, the predominate motions are attributed to wavelike disturbances with a 4-day period. For this case the upper-region of strong turbulence may be due in large part to vertical wind-shear resulting from a rapid decrease in wind speed within a relatively short distance about the Venera-Mariner band of high speed winds. Author

N75-28987*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF THE MASSES OF THE EARTH, MOON AND THE SUN AND THE SIZE OF THE EARTH FROM MARINER 9 RANGE AND DOPPLER OBSERVATIONS
C. F. Martin (Wolf Res. and Develop. Group., Riverdale, Md.), S. M. Klosko (Wolf Res. and Develop. Group, Riverdale, Md.), and J. W. Ryan Jun. 1975 91 p refs
(NASA-TM-X-70929; X-922-75-134) Avail: NTIS HC $4.75 CSCL 03B

S-Band observations from Mariner 9 tracking by the Deep Space Network were used to estimate gravitational constants for the earth, moon and sun, simultaneously with the estimation of the spin axis distances and longitudes for the tracking stations at Goldstone, California, Woomera, Australia, Johannesburg, South Africa, and Cebreros, Spain. Error analyses of the results indicate that the solar mass is in good agreement with the very accurately known value based on the Astronomical Unit; that the lunar mass is consistent with other recent determinations to better than .2 sigma. Accuracies of recovered spin axis distances are also estimated. Author

N75-28988*# McDonald Observatory, Austin, Tex.
LASER OBSERVATIONS OF THE MOON: NORMAL POINTS FOR 1973
J. Derral Mulholland, Peter J. Shelus, and Eric C. Silverburg

[1975] 26 p refs
(Grants NGR-44-012-165; NGR-44-012-219)
(NASA-CR-143210) Avail: NTIS HC $3.75 CSCL 03B

McDonald Observatory lunar laser ranging observations for 1973 are presented in the form of compressed normal points and amendments for the 1969-1972 data set are given. Observations of the reflector mounted on the Soviet roving vehicle Lunakhod 2 have also been included. Author

N75-28989*# California Univ., Berkeley. Space Sciences Lab.
INFRARED SPECTRA OF PLANETARY ATMOSPHERES Semiannual Report, 1 Jan. - 30 Jun. 1975
C. H. Townes Aug. 1975 8 p refs
(Grant NGR-05-003-452)
(NASA-CR-143218; SSL-Ser-16-Issue-37) Avail: NTIS HC $3.25 CSCL 03B

The development of high spectral resolution and highly sensitive long infrared wavelength instruments is reported. This instrumentation is used to examine molecular lines in planetary atmospheres in enough detail to obtain new information about these atmospheres. Such information includes (1) pressure and temperature relations in planetary atmospheres, and (2) molecular and isotopic composition. Author

N75-28990*# Holifield National Lab., Oak Ridge, Tenn.
NUCLEAR CHEMISTRY OF RETURNED LUNAR SAMPLES: NUCLIDE ANALYSIS BY GAMMA-RAY SPECTROMETRY Final Report, period ending 31 May 1975
G. Davis OKelley 31 May 1975 46 p refs Sponsored in part by ERDA
(NASA Order T-2400-A)
(NASA-CR-141913) Avail: NTIS HC $3.75 CSCL 03B

Primordial and cosmogenic radionuclide concentrations are determined nondestructively by gamma-ray spectrometry in soil and rock samples from the returned Apollo 17 sample collection from Taurus-Littrow and Descartes. Geochemical evidence in support of field geology speculation concerning layering of the subfloor basalt flows is demonstrated along with a possible correlation of magmatic fractionation of K/U as a function of depth. The pattern of radionuclide concentrations observed in these samples is distinct due to proton bombardment by the intense solar flares of August 4-9, 1972. Such radionuclide determinations are used in determining lunar sample orientation and characterizing solar flare activity. J.M.S.

N75-28991*# Holifield National Lab., Oak Ridge, Tenn.
INTERACTION OF GASES WITH LUNAR MATERIALS Final Report, period ending 31 May 1975
H. F. Holmes and R. B. Gammage 31 May 1975 62 p refs Sponsored in part by ERDA
(NASA Order T-9380-A)
(NASA-CR-141914) Avail: NTIS HC $4.25 CSCL 03B

The surface properties of lunar fines were investigated. Results indicate that, for the most part, these properties are independent of the chemical composition and location of the samples on the lunar surface. The leaching of channels and pores by adsorbed water vapor is a distinguishing feature of their surface chemistry. The elements of air, if adsorbed in conjunction with water vapor or liquid water, severely impedes the leaching process. In the absence of air, liquid water is more effective than water vapor in attacking the grains. The characteristics of Apollo 17 orange fines were evaluated and compared with those of other samples. The interconnecting channels produced by water vapor adsorption were found to be wider than usual for other types of fines. Damage tracks caused by heavy cosmic ray nuclei and an unusually high halogen content might provide for stronger etching conditions upon exposure to water vapor. Author

N75-28992*# Harvard Univ., Cambridge, Mass. Hoffman Lab.
MELTING BEHAVIOR AND PHASE RELATIONS OF LUNAR SAMPLES Semiannual Progress Report, 1 Feb. 1975 - 31 Jul. 1976
James Fred Hays [1975] 67 p refs
(Grant NGL-22-007-247)
(NASA-CR-143258) Avail: NTIS HC $4.25 CSCL 03B

Cooling rate studies of 12002 were conducted and the results interpreted in terms of the crystallization history of this rock and certain other picritic Apollo 12 samples. Calculations of liquid densities and viscosities during crystallization, crystal settling velocities, and heat loss by the parent rock body are discussed, as are petrographic studies of other Apollo 12 samples. The process of magmatic differentiation that must have accompanied the early melting and chemical fractionation of the moon's outer layers was investigated. The source of regions of both high- and low-titanium mare basalts were also studied. Author

N75-28993*# Rice Univ., Houston, Tex. Dept. of Space Physics and Astronomy.
PLANETARY SPECTRA FOR ANISOTROPIC SCATTERING
Joseph W. Chamberlain [1975] 20 p refs
(Grant NsG-7043)
(NASA-CR-143256) Avail: NTIS HC $3.25 CSCL 03B

Some of the effects on planetary spectra that would be produced by departures from isotropic scattering are examined. The phase function is the simplest departure to handle analytically and the only phase function, other than the isotropic one, that can be incorporated into a Chandrasekhar first approximation. This approach has the advantage of illustrating trends resulting from anisotropies while retaining the simplicity that yields physical insight. An algebraic solution to the two sets of anisotropic H functions is developed in the appendix. It is readily adaptable to progammable desk calculators and gives emergent intensities accurate to 0.3 percent, which is sufficient even for spectroscopic analysis. Author

N75-28830* American Science and Engineering, Inc., Cambridge, Mass.
PLANETARY INVESTIGATION UTILIZING AN IMAGING SPECTROMETER SYSTEM BASED UPON CHARGE INJECTION TECHNOLOGY
R. B. Wattson, P. Harvey, and R. Swift *In* JPL Proc.: Symp. on Charge-Coupled Device Technol. for Sci. Imaging Appl. 10 Jun. 1975 p 70-79 refs (For availability see N75-28824 19-70) CSCL 03B

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

N75-28994*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POSITRON ANNIHILATION IN SOLAR FLARES
Carol Jo Crannell, Reuven Ramaty, and Carl Werntz (Catholic Univ. of America) Jul. 1975 11 p refs Presented at 14th Intern. Cosmic Ray Conf., Munich, 15-29 Aug. 1975
(NASA-TM-X-70937; X-682-75-167; SP-3-6) Avail: NTIS HC $3.25 CSCL 03B

The gamma ray line at 0.51 MeV originates from the annihilation of positrons. When a fraction of the positrons annihilate from bound states of positronium, the 0.51-MeV line is accompanied by a continuum of 3-gamma annihilation radiation at energies up to 0.51 MeV. Accurate calculations of the rates of free annihilation and positronium formation in a solar flare plasma are presented and positronium formation by charge exchange is discussed. The observability of the 3-gamma annihilation is increased by the inherent delay in the production and slowing down time of the positrons. It was concluded that such radiation could be detected at times late in solar gamma ray events when the continuum and prompt line emissions have essentially disappeared. Author

N75-28995# Air Force Cambridge Research Labs., L. G. Hanscom Field, Mass.
A SIMPLIFIED METHOD FOR COMPUTING RADIATIVE ENERGY LOSS DUE TO SPECTRAL LINES. 2: PROGRAMS FOR SOLAR FLARE MODELS Environmental Research Papers
Richard C. Canfield 26 Mar. 1974 28 p refs
(AF Proj. 7649)
(AD-A005390; AFCRL-ERP-471; AFCRL-TR-74-0158) Avail: NTIS CSCL 03/2

The paper lists FORTRAN-IV programs that implement a simplified method for computing radiative loss rates due to spectral lines. As it is planned to apply these techniques to solar flare models, the programs are set up to take into account Lyman alpha, Balmer-alpha and H-, the principal contributors to radiative energy loss in solar flares. GRA

93 SPACE RADIATION

Includes cosmic radiation and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N75-28996 British Library Lending Div., Boston Spa (England).
VARIATION IN THE CENTRE-LIMB PROFILES OF WEAK FRAUNHOFER LINES 2 ASYMMETRY AND LINE WIDTHS
E. A. Gurtovenko Dec. 1974 23 p refs Transl. into ENGLISH from Astronom. Astrofiz. (USSR), no. 16, 1972 p 77-91
(BLL-RTS-9125) Avail: British Library Lending Div., Boston Spa, Engl.: £4.40; 7 BLL photocopy coupons

The observations were performed using a double-solar monochromator. The asymmetry of very weak lines was found to be highly varied, which may be associated with the superfine structure. Results are in accord with the theoretical interpretation of the asymmetry of traveling sonic waves. Observations of the same lines on different dates indicate a possible change in asymmetry with time. The turbulence velocities calculated from the widths of certain elements exhibit considerable diversity. The lines of the light elements S, Si, and N appear to be very wide. The effect of superfine and isotopic structure is shown to change to a marked degree the form and width of the profiles of many Fraunhofer lines. Author

N75-28997*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
INTERPRETATION OF THE PULSED GAMMA RAY EMISSION FROM VELA
D. J. Thompson Jun. 1975 11 p refs Submitted for publication
(NASA-TM-X-70936; X-662-75-164) Avail: NTIS HC $3.25 CSCL 03B

A model is proposed for the Vela pulsar in which the radio emission originates near the surface of the neutron star while the pulsed gamma ray emission is produced by synchrotron radiation near the speed of light cylinder. This model can explain the energy flux, double pulse structure, and phase shift with respect to the radio of the gamma ray emission and offers approximate quantitative predictions for other X-ray and gamma-ray fluxes. Author

N75-28998*# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Science.
AN INVESTIGATION OF ESSA 7 RADIATION DATA FOR USE IN LONG-TERM EARTH ENERGY EXPERIMENTS, PHASES 1 AND 2 Final Report
Frederick B. House [1974] 72 p refs
(Contract NAS1-11871)
(NASA-CR-132623) Avail: NTIS HC $4.25 CSCL 03B

The results are presented of an investigation of ESSA 7 satellite radiation data for use in long-term earth energy experiments. Satellite systems for performing long-term earth radiation balance measurements over geographical areas, hemispheres, and the entire earth for periods of 10 to 30 years are examined. The ESSA 7 satellite employed plate and cone radiometers to measure earth albedo and emitted radiation. Each instrument had a black and white radiometer which discriminated the components of albedo and emitted radiation. Earth measurements were made continuously from ESSA 7 for ten months. The ESSA 7 raw data is processed to a point where it can be further analyzed for: (1) development of long-term earth energy experiments; and (2) document climate trends. Author

N75-28999*# Drexel Univ., Philadelphia, Pa. Dept. of Physics and Atmospheric Science.
STEADY-STATE SOLUTION TO THE CONDUCTION PROBLEM OF A SPHERICAL BALLOON RADIOMETER, PHASES 1 AND 2 Final Report
Frederick B. House and Alan J. Cimorelli [1974] 29 p refs
(Contract NAS1-11871)
(NASA-CR-132624) Avail: NTIS HC $3.75 CSCL 03B

A satellite system proposed for observing the earth's radiation balance employing spherical balloon radiometers is investigated. In the steady-state condition of radiative equilibrium, the magnitudes of absorbed external irradiances are sensed by internal radiometers mounted on the skin of each balloon. The temperatures of the radiometers are monitored as a measure of the balloons' internal irradiances (equal to absorbed external irradiances) and telemetered to earth. The effect of the magnitude of irradiant sources, balloon thickness, and thermal conductivity on the conduction of heat is assessed mathematically in order to determine its impact on measurement accuracy. Results indicate that observations are acceptable during daytime and nighttime modes of operation. Author

99 GENERAL

N75-29000+ Karlsruhe Univ. (West Germany). Sonderforschungsbereich 80 Ausbreitungsund Transportvorgaenge in Stroemungen.
BIBLIOGRAPHY OF LASER-DOPPLER-ANEMOMETRY LITERATURE
F. Durst and M. Zare Nov. 1974 59 p refs
(KU-SFB-80/M/44) Avail: NTIS HC $4.25

Over 600 references on laser-Doppler are presented. It comprises 639 references from 1966 to Autumn 1974 with some references on related subjects as early as 1908. Twelve categories were established including reviews, optics, electronics, scattering, particles, air flow, water flow, high speed flow, flames, combustion systems, and miscellanea. Each category is subdivided into theoretical and experimental aspects and to each citation is attached a grid enabling instant recognition of the categories/treatments to which it belongs. ESRO

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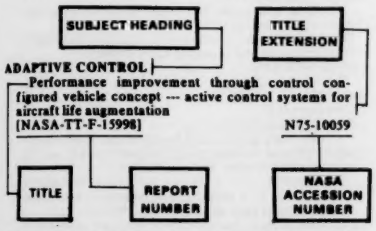

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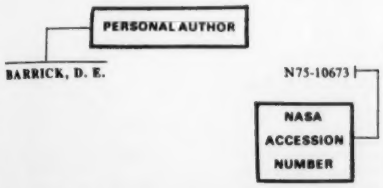

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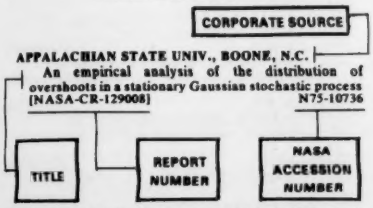

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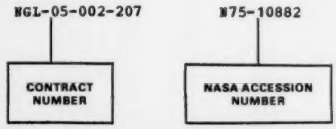

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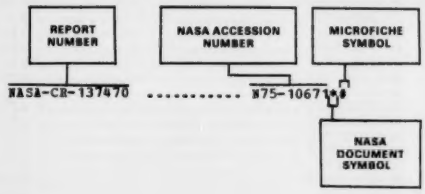

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AD-A005702 ..... N75-28935 #
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AD-A005729 ..... N75-28797 #
AD-A005818 ..... N75-28060 #
AD-A006157 ..... N75-28061 #

AD-781546 ..... N75-28124 #

ADL-C-75519 ..... N75-28873 #
ADL-C-77105 ..... N75-28529 #
ADL-C-77591 ..... N75-28552 #

ADL-78036 ..... N75-28518*#

AERONOMICA-ACTA-A-128-1974 ..... N75-28591
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AES-7417 ..... N75-28810 #

AEWES-MISC-PAPER-H-74-11 ..... N75-28667 #

AEWES-TR-M-74-2 ..... N75-28505 #

AEWES-TR-S-75-1 ..... N75-28236 #

AFAPL-TR-74-90 ..... N75-28074 #
AFAPL-TR-74-115 ..... N75-28248 #

AFCRL-ERP-471 ..... N75-28995 #
AFCRL-ERP-477 ..... N75-28651 #
AFCRL-ERP-478 ..... N75-28649 #

AFCRL-IP-216 ..... N75-28872 #

AFCRL-TR-74-0134 ..... N75-28872 #
AFCRL-TR-74-0158 ..... N75-28995 #
AFCRL-TR-74-0249 ..... N75-28651 #
AFCRL-TR-74-0250 ..... N75-28649 #
AFCRL-TR-74-0346 ..... N75-28401 #
AFCRL-TR-74-0585 ..... N75-28606 #
AFCRL-TR-75-0047 ..... N75-28504 #
AFCRL-TR-75-0051 ..... N75-28600 #

AFFDL-TR-73-129-VOL-2 ..... N75-28051 #
AFFDL-TR-74-109-VOL-1 ..... N75-28060 #
AFFDL-TR-74-109-VOL-2 ..... N75-28061 #

AFGWC-TM-74-2 ..... N75-28046 #

AFHRL-TR-74-57-VOL-3 ..... N75-28704 #
AFHRL-TR-74-57-VOL-4 ..... N75-28705 #
AFHRL-TR-74-73 ..... N75-28966 #

AFLRL-35 ..... N75-28254 #
AFLRL-42 ..... N75-28253 #

AFML-TR-74-131 ..... N75-28212 #
AFML-TR-74-133 ..... N75-28221 #
AFML-TR-74-162 ..... N75-28935 #
AFML-TR-74-224 ..... N75-28220 #
AFML-TR-74-235 ..... N75-28933 #
AFML-TR-74-270 ..... N75-28961 #

AFOSR-TR-42 ..... N75-28797 #

AFOSR-74-0273TR ..... N75-28131 #
AFOSR-75-0161TR ..... N75-28893 #
AFOSR-75-0169TR ..... N75-28711 #
AFOSR-75-0170TR ..... N75-28710 #
AFOSR-75-0173TR ..... N75-28762 #
AFOSR-75-0174TR ..... N75-28616 #
AFOSR-75-0175TR ..... N75-28891 #

AFOSR-75-0179TR ..... N75-28291 #
AFOSR-75-0194TR ..... N75-28764 #
AFOSR-75-0195TR ..... N75-28798 #
AFOSR-75-0197TR ..... N75-28761 #
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AFOSR-75-0199TR ..... N75-28766 #
AFOSR-75-0200TR ..... N75-28760 #
AFOSR-75-0211TR ..... N75-28892 #
AFOSR-75-0212TR ..... N75-28217 #
AFOSR-75-0244TR ..... N75-28652 #
AFOSR-75-0245TR ..... N75-28610 #
AFOSR-75-0249TR ..... N75-28797 #
AFOSR-75-0264TR ..... N75-28475 #
AFOSR-75-0265TR ..... N75-28612 #
AFOSR-75-0274TR ..... N75-28799 #
AFOSR-75-0275TR ..... N75-28963 #
AFOSR-75-0276TR ..... N75-28763 #
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AFRPL-TR-74-72 ..... N75-28256 #

AGARD-CP-162 ..... N75-28011 #

AIRESEARCH-AP-75-11133 ..... N75-28071*#
AIRESEARCH-AP-75-11502 ..... N75-28067*#

AMA-74-34-PT-1 ..... N75-28084*#
AMA-74-34-PT-2 ..... N75-28085*#

AMMRC-CTR-74-63 ..... N75-28145 #

AMMRC-TR-74-33 ..... N75-28175 #

AMRL-TR-74-118 ..... N75-28082 #

APTIC-75067 ..... N75-28572 #
APTIC-75069 ..... N75-28570 #

AP75-17 ..... N75-28108*#

AR-14 ..... N75-28121*#

ARC-R/M-3758 ..... N75-28031 #
ARC-R/M-3766 ..... N75-28034 #

ARC-34689 ..... N75-28031 #
ARC-34707 ..... N75-28031 #
ARC-35099 ..... N75-28034 #

ARL-MR-73-0001 ..... N75-28960 #

ARL/ME-NOTE-353 ..... N75-28064 #
ARL/ME-144 ..... N75-28426 #

ARO-9204-1-EN ..... N75-28382 #
ARO-9894-11-EN ..... N75-28510 #
ARO-11823-1-E ..... N75-28441 #
ARO-12049.5-EL ..... N75-28343 #

AROD-5199-21-C ..... N75-28124 #

ASD-TR-36 ..... N75-28075 #

BBC-RD-1975/2 ..... N75-28388
BBC-RD-1975/3 ..... N75-28263
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BII-230-2 ..... N75-28335 #

BLL-BTI-746-1487-(9022.401) N75-28180
BLL-BTI-0746-01493-(9022.401) N75-28132

BLL-CE-TRANS-6395-(9022.09) N75-28063

BLL-LTI-746-1427-(9022.401) N75-28181
BLL-LTI-746-1455-(9022.401) N75-28133
BLL-LTI-746-1492-(9022.401) N75-28182
BLL-LTI-746-1495-(9022.401) N75-28185
BLL-LTI-746-1496-(9022.401) N75-28184

BLL-M-TRANS-23455-(5828.4F) N75-28647
BLL-M-TRANS-23645-(5828.4F) N75-28311

BLL-M-21959-(5828.4F) N75-28352
BLL-M-21960-(5828.4F) N75-28387
BLL-M-21964-(5828.4F) N75-28897
BLL-M-21965-(5828.4F) N75-28190
BLL-M-21966-(5828.4F) N75-28898
BLL-M-21967-(5828.4F) N75-28189

BLL-M-23406-(5828.4F) N75-28623
BLL-M-23407-(5828.4F) N75-28355
BLL-M-23408-(5828.4F) N75-28644
BLL-M-23409-(5828.4F) N75-28586
BLL-M-23410-(5828.4F) N75-28638
BLL-M-23413-(5828.4F) N75-28516
BLL-M-23414-(5828.4F) N75-28354
BLL-M-23428-(5828.4F) N75-28553
BLL-M-23430-(5828.4F) N75-28554
BLL-M-23445-(5828.4F) N75-28481
BLL-M-23453-(5828.4F) N75-28590
BLL-M-23454-(5828.4F) N75-28917
BLL-M-23461-(5828.4F) N75-28639
BLL-M-23505-(5828.4F) N75-28476
BLL-M-23530-(5828.4F) N75-28637
BLL-M-23532-(5828.4F) N75-28641
BLL-M-23533-(5828.4F) N75-28640
BLL-M-23534-(5828.4F) N75-28622
BLL-M-23535-(5828.4F) N75-28621
BLL-M-23539-(5828.4F) N75-28581
BLL-M-23542-(5828.4F) N75-28618
BLL-M-23543-(5828.4F) N75-28619
BLL-M-23549-(5828.4F) N75-28582
BLL-M-23550-(5928.4F) N75-28636
BLL-M-23552-(5828.4F) N75-28633
BLL-M-23553-(5828.4F) N75-28643
BLL-M-23554-(5828.4F) ..... N75-28620 *
BLL-M-23555-(5828.4F) N75-28580
BLL-M-23556-(5828.4F) N75-28634
BLL-M-23558-(5828.4F) N75-28585
BLL-M-23560-(5828.4F) N75-28801
BLL-M-23561-(5828.4F) N75-28632
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BLL-M-23568-(5828.4F) N75-28626
BLL-M-23569-(5828.4F) N75-28406
BLL-M-23570-(5828.4F) N75-28579
BLL-M-23572-(5828.4F) N75-28635
BLL-M-23573-(5828.4F) N75-28584
BLL-M-23575-(5828.4F) N75-28630
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BLL-M-23620-(5828.4F) N75-28631
BLL-M-23633-(5828.4F) N75-28356
BLL-M-23634-(5828.4F) N75-28645
BLL-M-25004-(5828.4F) N75-28186
BLL-M-25056-(5828.4F) N75-28421
BLL-M-25057-(5828.4F) N75-28450
BLL-M-25059-(5828.4F) N75-28449
BLL-M-25062-(5828.4F) N75-28788

BLL-NEL-TT-2540-(6075.461) N75-28134
BLL-NEL-TT-2556-(6075.461) N75-28357
BLL-NEL-TT-2563-(6075.461) N75-28729
BLL-NEL-TT-2566-(6075.461) N75-28183
BLL-NEL-TT-2573-(6075.461) N75-28188
BLL-NEL-TT-2575-(6075.461) N75-28353
BLL-NEL-TT-2594-(6075.461) N75-28149
BLL-NEL-TT-2596-(6075.461) N75-28407
BLL-NEL-TT-2607-(6075.461) N75-28422

BLL-RRE-TRANS-427-(8036.625) N75-28265
BLL-RRE-TRANS-428-(8036.625) N75-28896
BLL-RRE-TRANS-433-(8036.625) N75-28266

BLL-RTS-8785 ..... N75-28453
BLL-RTS-9084 ..... N75-28187
BLL-RTS-9125 ..... N75-28996

BLL-TRANS-889-(9022.64) N75-28895
BLL-TRANS-3147-(9022.81) N75-28267
BLL-TRANS-3160-(9022.81) N75-28299
BLL-TRANS-3186-(9022.81) ..... N75-28389 *
BLL-TRANS-3187-(9022.81) N75-28224

BM-IC-8668 ..... N75-28569 #
BM-IC-8670 ..... N75-28740 #
BM-IC-8671 ..... N75-28506 #

BM-OFR-4-75 ..... N75-28552 #
BM-OFR-6-75 ..... N75-28724 #
BM-OFR-20-75 ..... N75-28526 #

BM-RI-8005 ..... N75-28172 #
BM-RI-8011 ..... N75-28548 #
BM-RI-8017 ..... N75-28515 #

BM-SP-1-75 ..... N75-28514 #

BMR-2 ..... N75-28285 #

BRL-CR-175 ..... N75-28255 #

BRL-MR-2436 ..... N75-28809 #

BRL-1737 ..... N75-28383 #
BRL-1755 ..... N75-28092 #

BUMINES-OFR-8-75 ..... N75-28725 #

BW-TR-557 ..... N75-28147 #

C-401-4 ..... N75-28532 #
C-1037-II-1 ..... N75-28485*#

CAA-TP-74-10 ..... N75-28811 #

CE/NEL-134 ..... N75-28174 #

CEL-CR-74-008 ..... N75-28576 #
CEL-CR-75.004 ..... N75-28470 #

CEL-TN-1366 ..... N75-28322 #
CEL-TN-1373 ..... N75-28239 #
CEL-TN-1374 ..... N75-28238 #
CEL-TN-1375 ..... N75-28349 #

CEL-TR-1367 ..... N75-28237 #

CEL-75.005 ..... N75-28471 #

CGR/DC-28/74 ..... N75-28668 #

CLM/RR/E1/19 ..... N75-28114 #

COM-75-10355/6 ..... N75-28655 #
COM-75-10358/0 ..... N75-28661 #
COM-75-10367/1 ..... N75-28321 #
COM-75-10368/9 ..... N75-28563 #
COM-75-10370/5 ..... N75-28262 #
COM-75-10388/7 ..... N75-28656 #
COM-75-10396/0 ..... N75-28944 #
COM-75-10417/4 ..... N75-28444 #
COM-75-10419/0 ..... N75-28173 #
COM-75-10421/6 ..... N75-28969 #
COM-75-10433/1 ..... N75-28507 #

CRREL-SR-216 ..... N75-28658 #

CTAB-75-2 ..... N75-28530 #

DCIEM-74-R-1059 ..... N75-28065 #

DDC-TAS-74-38 ..... N75-28726 #
DDC-TAS-74-41 ..... N75-28958 #

DMS-AR-1021 ..... N75-28042 #

DMS-DR-2192-VOL-1 ..... N75-28101*#
DMS-DR-2221 ..... N75-28091*#
DMS-DR-2234 ..... N75-28107*#
DMS-DR-2252 ..... N75-28109*#

DM75-05-10 ..... N75-28280*#

DNA-3410F ..... N75-28171 #
DNA-3490F ..... N75-28865 #
DNA-3501F ..... N75-28615 #

DOT-HS-801-453 ..... N75-28286 #

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